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The Status of the Gartersnake, *Thamnophis sirtalis tetrataenia*

WADE FOX

HERPETOLOGISTS have long been puzzled by the fact that specimens of *Thamnophis sirtalis tetrataenia* collected at Pit River, the presumed type locality, differ markedly in color pattern from the specimens of this subspecies upon which the original description was based (Cope, in Yarrow, 1875: 546). However, since replicas of the cotypes were not known to exist elsewhere, and there seemed no other reason to question the validity of the type locality, the aberrant cotypes were thought to be an abnormal pattern phase (Fitch, 1941: 585). The redescription of the coloration of the subspecies has consequently been based on a newly collected snake from the Pit River.

Recently I have found a population of *Thamnophis sirtalis* on the San Francisco peninsula in which the individuals are distinctively marked. In reviewing this species, Fitch (1941) indicated that the race *T. s. infernalis* occupies this peninsula as well as most of coastal California. Since he had few specimens from the peninsular locality, he had little reason to suspect that a well differentiated population exists in this small area. Suggestions from Fitch, and suspicions of my own, led to a comparison of the form on the peninsula with the original specimens of *Thamnophis sirtalis tetrataenia* from Pit River, California. The distinctive color pattern of the cotypes is the same as that of the San Francisco peninsula specimens. This similarity suggests that the "Pit River" specimens were collected on the San Francisco peninsula and that the name *T. s. tetrataenia* rightfully belongs to this population.

If the above assumption is true, certain taxonomic changes are necessary. In order to present the evidence for these changes, it will be necessary to review the very complicated taxonomic history of *T. s. tetrataenia* in detail.

The first mention of the name *tetrataenia* occurred in a key to the gartersnakes of the western United States (Yarrow, 1875: 546). Yarrow plainly did not intend this to serve as a description of a new subspecies. He acknowledged Cope's aid with the genus and stated that he had obtained permission to use Cope's synopsis of the genus. Later Yarrow (1882) refers to the race as *Eutaenia sirtalis tetrataenia* Cope, giving further recognition to Cope as the original describer. However, Cope's description did not appear until 1892 and it was not designated as the description of a new subspecies; the race was referred to as "*Eutaenia sirtalis tetrataenia* Cope. In Yarrow's Report of U. S. Expl. Surv., W. of 100th mer., v, 1875, p. 546."

If the description in Yarrow (1875) is adequate, it must serve as the original description. No locality was given for the race, nor does the name *tetrataenia* appear elsewhere than in the key to the gartersnakes. Fortunately, the description given by means of this key distinguishes *E. s. tetrataenia* from the other gartersnakes. I follow Fitch (1941) in accepting this as the original description of *T. s. tetrataenia,* but I prefer to follow the suggestion of L. M.

Klauber and E. R. Dunn (personal communications) and credit the description to Cope (in Yarrow, 1875: 546).

The second major aspect of the problem concerns the type specimens. Although no locality was given for *E. s. tetrataenia* by Yarrow in 1875, later in the same year Cope published a check-list of North American amphibians and reptiles in which he listed "*Eutaenia sirtalis*, Linn., subspecies *tetrataenia*, Cope, MS. Pitt River, California" (Cope, 1875: 41). It is clear from this that the description in Yarrow was based on specimens presumably from Pit River, California. Yarrow (1883: 128) lists "*Eutaenia sirtalis tetrataenia* (Linn.) Cope," and cites Cope's manuscript as the reference. He records 2 specimens from "Pitt River, Cal.," (catalogued as No. 866) received as alcoholic specimens from Lieut. R. S. Williamson, U. S. A. Townsend (1887: 240) lists "*Eutaenia sirtalis tetrataenia* (Linn.), Cope. California Garter Snake. Pill River. Lieutenant Williamson."

These references leave no doubt that the earlier description in Cope's manuscript was based only on the "Pit River" specimens. When Cope's complete description appeared (1892), a specimen from Puget Sound, Washington, was listed in addition to the two "Pit River" specimens. Since there is no mention of the Puget Sound specimen prior to this date, it appears certain that the earlier description was based on the "Pit River" specimens alone.

It has already been established that Cope did not regard the 1892 description as the original description of a new subspecies. However, (p. 664) he says "In the typical specimen the tip of the tail is injured . . . the superior labials eight . . . gastrosteges, 158; urosteges, 68 +. Total length, 800 milimeters, of tail (tip lost), 118 +." These scale counts and measurements were taken from the Puget Sound specimen, and it appears that Cope might have wanted to specify that this specimen was the type. On the other hand, since the Puget Sound specimen was not mentioned in any of the earlier accounts it was very probably not part of the typical material included in Cope's original manuscript to which Yarrow made reference. E. R. Dunn (personal communication) also makes the point that Cope did not use the words type or typical in the modern sense.

In his check-list Cope (1875) gave rather broad general ranges for the other forms of gartersnakes, but for *T. s. tetrataenia* he gave only Pit River. If he had known of the Puget Sound specimen at this time, surely he would have listed the locality.

Both Dunn and Klauber (personal communications) agree with me that the Puget Sound specimen has no justified claim as type material. The data reviewed above show that it was not indicated in the original references to *E. s. tetrataenia*, whereas the "Pit River" specimens were mentioned. The latter, logically, should be regarded as the type material. Fitch (1941) has already explained many of these points and has actually settled the question by selecting one of the two "Pit River" specimens as the lectotype. This specimen is now catalogued as U. S. Nat. Mus. No. 21384. It is my opinion that this selection should be respected. Certainly, there does not appear to be any new information that warrants the selection of a new lectotype.

Although it has no bearing on the status of *T. s. tetrataenia*, there is another important point that should be revealed concerning the Puget Sound

specimen. This specimen was reported by Brown (1903: 293) to be No. 6085 in the collection of the Academy of Natural Sciences of Philadelphia. Dr. E. R. Dunn has examined all the data concerning this specimen and very kindly informed me of his findings. Specimen No. 6085 has been maintained in the same bottle with another gartersnake of the same species, No. 6086. They were both catalogued at the same time, probably in the nineties, and may have been received from the Smithsonian Institution, as were many other specimens. Apparently no labels bearing collection data were attached to the specimens at the time of preservation. The Academy catalogue gives the locality of collection as Puget Sound. Dunn says that there is a loose label in the bottle which was once attached to No. 6085 and on which he can barely make out the word "tetrataenia" and the words "Puget Sound." The collector of the specimens is not known. My purpose in pointing out these details is to indicate the possibility that the recorded locality for these specimens is in error.

Since my correspondence with Dunn it was my privilege to visit the Academy and examine the specimens. On the basis of their very distinct color patterns I believe that neither of them came from Puget Sound. Specimen No. 6086 appears identical with the hundreds of specimens of *Thamnophis sirtalis infernalis* that I have examined and most likely was collected in Marin County or possibly Sonoma County, California. The distinctive color pattern of No. 6085 places it, without doubt, as a member of the San Francisco peninsula population. It should, therefore, be called *T. s. tetrataenia,* the name that this paper proposes for the subspecies inhabiting the San Francisco peninsula.

The true locality of the "Pit River" specimens remains to be established. As already stated, they are nearly identical with other specimens from the San Francisco peninsula and the color pattern of these snakes cannot easily be confused with that of any other race. The specimens are listed in several sources as having been received at the Smithsonian Institution in shipment from Lieut. R. S. Williamson. Apparently some specimens in this shipment were from the vicinity of Pit River, California. These particular gartersnakes are labeled as collected by Dr. J. S. Newberry, who served as geologist and naturalist in the party exploring for a railroad route from the Sacramento Valley to the Columbia River under the command of Lieut. R. S. Williamson in 1855. An account of the trip was written by Lieut. Henry L. Abbot, the second in command (1857). Lieut. Williamson arrived in San Francisco by boat on May 5, 1855, and there organized the exploration party. The party assembled at Benicia on July 9, 1855, in preparation for departure. Meanwhile, ample opportunity was available for collecting the snakes around San Francisco. The party was in the vicinity of the Pit River during the first week of August. Later Dr. Newberry became ill and returned to San Francisco, where, as stated by Abbot, he spent his time vigorously accumulating a large zoological collection. He had, therefore, the opportunity to collect the snakes at San Francisco, and if he traveled south of the city for as much as ten miles, he could hardly have escaped seeing them. It must be concluded that somewhere the name "Pit River" was erroneously associated with the peninsula specimens. Further evidence of the opportunity for the specimens

to have come from San Francisco lies in the fact that others, admittedly collected there, were received by the Smithsonian Institution from Lieut. Williamson.

As with the "Puget Sound" specimens, no collector's labels are attached to the "Pit River" specimens to certify the locality. With the evidence presented it is clear that *T. s. tetrataenia* must be redefined and a new name applied to the distinct race formerly regarded as *T. s. tetrataenia* (Fitch, 1941).

PROPOSED TAXONOMIC CHANGES.—In a recent study of Linnaean names, Klauber (1948) proposed a change of nomenclature for the species formerly known as *Thamnophis sirtalis*. He pointed out that the name *sirtalis* should be applied to the ribbonsnake which had hitherto been referred to as *T. sauritus*. The available name for the common gartersnake was *Thamnophis ordinatus* (Linnaeus), 1766. These changes in names of common species that have been used for many years are objected to by many herpetologists. I personally find no difficulty in accepting the change, but since at the time of writing this paper there is considerable indication that the old names will be reinstated on the basis of usage (K. P. Schmidt, personal communication), I am using the pre-Klauber names.

Thamnophis sirtalis tetrataenia (Cope in Yarrow)

Coluber infernalis, Blainville, 1835: 291 (part).
Eutaenia sirtalis tetrataenia Cope in Yarrow, 1875: 546 (original description).
Eutaenia imperialis, Coues and Yarrow, 1878: 280.
Tropidonotus sirtalis parietalis, Garman, 1883: 25.
Eutaenia infernalis, Bocourt, 1892: 40 (part).
Tropidonotus ordinatus var. *infernalis*, Boulenger, 1893: 207 (part).
Thamnophis parietalis, Van Denburgh, 1897: 200 (part).
Thamnophis sirtalis infernalis, Van Denburgh and Slevin, 1918: 198 (part).
Thamnophis ordinatus infernalis, Klauber, 1948: 10 (part).

LECTOTYPE.—U. S. Nat. Mus. No. 21384 (originally No. 866) selected by Fitch (1941).

TYPE LOCALITY.—"Banks of Pit River, California" in error. Type specimen undoubtedly came from the San Francisco peninsula.

RANGE.—Occupies the western portion of the San Francisco peninsula from about the San Francisco County line south along the crest of the peninsula hills at least to Crystal Lake, and along the coast west of this region south to Point Año Nuevo, San Mateo County, California (Fig. 1).

DIAGNOSIS.—A *Thamnophis sirtalis* in which the top of the head is red; the red and black colors of the side of the body are arranged into one red between two black longitudinal stripes. These stripes extend from the neck to the anus and are uninterrupted except in the neck region of an occasional individual. Many specimens have a thin stripe of red below the lower black stripe. The sides of the tail are marked with alternating black and red bars.

DESCRIPTION.—The dorsal stripe occupies ½ + 1 + ½ scale rows and is pale green or blue-green. The typical lateral stripe, common to most gartersnakes, occupies the second and third scale rows. It is a pale blue-green and not strongly differentiated from the first scale row. The belly is also blue-green. The top of the head is red, the red extending down over the

superior margin of the supralabials and over both supra- and infralabials posteriorly. Aside from this the labials are pale blue and the throat becomes even paler, almost white. The iris is cinnamon.

There are usually seven upper labials, ten lower labials, one preocular, and three postoculars on each side. The scale rows are 19–19–17. Ventral scutes range from 156 to 172 in males and 153 to 169 in females. Caudal scutes range from 80 to 95 in males and 71 to 87 in females.

The following is a description of a freshly killed specimen, M.V.Z. No. 47716, female. Two uninterrupted dorsolateral black stripes run the entire length of the body and are separated from each other by a red stripe. Anteriorly, the lower black stripe occupies the upper half of the third scale row, all of the fourth, three-fourths to all of the fifth, and frequently encroaches

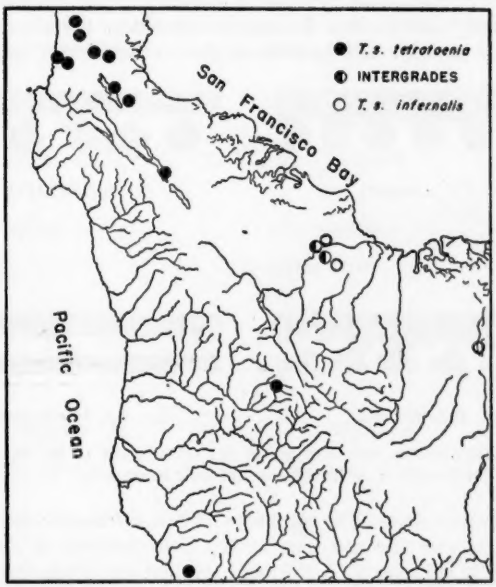

Fig. 1. Distribution and locality records of *T. s. tetrataenia* in California.

on the sixth scale row. Posteriorly, it occupies ½ + 1 + ½ scale rows, the third, fourth, and fifth respectively. The upper black stripe occupies ½ + 1 + ½ scale rows which are the seventh, eighth and ninth anteriorly and the sixth, seventh and eighth posteriorly. At the end of the body it touches the sixth row only slightly.

The red stripe varies from Scarlet (Ridgway nomenclature) on the anterior part of the scales to Brazil Red on the posterior part. It irregularly occupies ⅓ + 1 + ½ scale rows anteriorly and is limited posteriorly to the adjacent halves of the fifth and sixth scale rows. The middorsal stripe is Light Fluorite Green at the nape and Glaucous-Green posteriorly, and occupies ½ + 1 + ½ scale rows. The lateral stripe occupies nearly all of the

second and over half of the third scale row; it is Light Glaucous-Blue throughout, but has many conspicuous Grenadine Red flecks in the neck region. Although the first scale row is Glaucous-Blue, it is heavily marked with fine black punctations that also cover the lateral edges of the ventral scutes. Medially, the ventral scutes are Light Dull Glaucous-Blue. The black and red stripes of the body do not extend onto the tail which is marked by alternating black and red bars that become indistinct towards the tip.

The top of the head is Burnt Sienna from the snout through the temporals and over most of the sixth and seventh upper labials. The upper margin of the anterior labials is also reddish, but they are primarily Pale Glaucous-Blue. The lower labials are paler and grade into the Pale Dull Glaucous-Blue of the throat.

GEOGRAPHIC VARIATION AND RELATIONSHIPS.—This race was included with *T. s. infernalis* by Van Denburgh and Slevin (1918) and by Fitch (1941). This position was justified to some extent for it is most closely

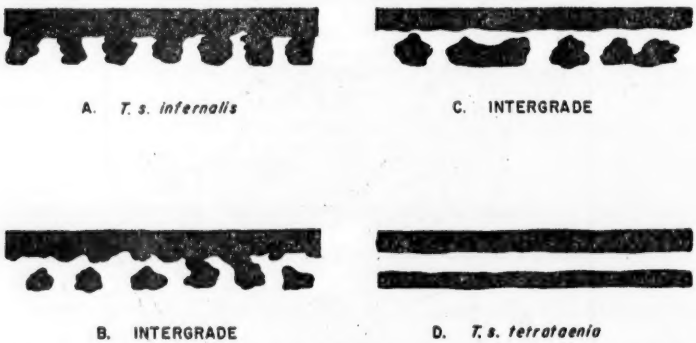

Fig. 2. Diagrammatic representation of the arrangement of the black pigment on the sides of *T. s. infernalis*, *T. s. tetrataenia*, and their intergrades.

related to this subspecies. The specimens of *T. s. tetrataenia* available to the earlier workers were few and were mostly from the area of intergradation. Furthermore, it occupies such a small area that there was little reason to suspect that a uniform population of these black and red striped forms existed.

The purest population of *T. s. tetrataenia* occurs on the coast around Sharp Park and along the ridge of the San Francisco peninsula east of Sharp Park. Strangely enough, there are no specimens of *T. sirtalis* available from San Francisco County, in spite of the fact that several lakes appear to offer a suitable habitat. It may be that these lakes have only recently become suitable and the snakes have not found them as yet, but this explanation is far from satisfactory. *Thamnophis sirtalis* does not appear to be strongly attached to home ranges; it is frequently found wandering a long way from a suitable feeding ground. What few marking data are available (Seibert and Hagen, 1947; Fitch, 1949) indicate that this species is less frequently recaptured in the same area than are several other species of snakes. Since

their known northernmost locality is only about three miles from the Lake Merced region of San Francisco, it is strange that there are no records from the latter vicinity. It is not impossible that they have escaped notice, yet considering the ease with which they can be found elsewhere and the extensive collecting done in the Lake Merced region, this hardly seems likely.

Intergradation between *T. s. tetrataenia* and *T. s. infernalis* takes place in the vicinity of Palo Alto, Santa Clara County, along the east side of the hills west of Palo Alto. Slight evidence of the influence of this intergradation can be seen in a few specimens from San Andreas Lake near the crest of the hills. Typical *T. s. infernalis* as well as intergrades have been taken at Palo Alto (Fig. 2). The continuity of the black and red stripes that characterize *T. s. tetrataenia* is broken in varying degrees in the intergrades until the pattern typical of *T. s. infernalis* is reached. In this form the lower black stripe is represented by a series of regularly spaced blotches which are continuous dorsally with the upper black stripe. The red color is, therefore, no

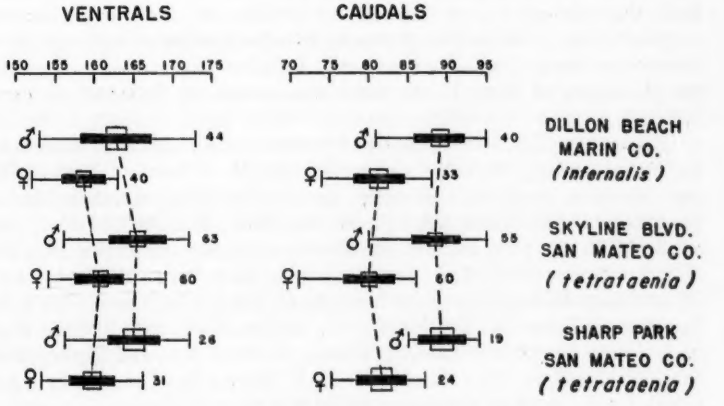

Fig. 3. Variation in numbers of ventral and caudal scutes in populations of *T. s. infernalis* and *T. s. tetrataenia.*

The range in numbers of these scutes is indicated by the horizontal line between the short vertical terminal bars; the solid rectangle represents the mean ± one standard deviation; the open square represents the mean ± twice the standard error. The figure to the right of the symbol indicates the number of individuals in the sample. The broken lines connect the means of the same sex.

longer in the form of a stripe but occupies the spaces between these lower black blotches.

Scale characters are very similar in the two races. Comparisons of numbers of ventral and caudal scutes of *T. s. tetrataenia* with those from a sample of *T. s. infernalis* from Marin County (Fig. 3) show that only the sample from the Skyline Boulevard, south of San Francisco, has significantly greater numbers of ventrals in both males and females than does *T. s. infernalis*, while the numbers of caudals do not differ significantly. The Sharp Park sample of *T. s. tetrataenia* does not differ significantly from Marin County specimens of *T. s. infernalis* in scale characters. There is almost no variation

in the number of scale rows. Although seven supralabials are typical for the species, eight are not infrequent in either *T. s. infernalis* or *T. s. tetrataenia.* There appears to be no significance in variations of labials, preoculars, and postoculars as far as these races are concerned.

Ecology.—This snake is most abundant in the vicinity of ponds and lakes; large creeks and streams are not numerous in the area. The animals are frequently found in the water or on the edge of a bank. If approached in either of these situations, they attempt to dive under water and hide among the water plants or occasionally they swim out of reach with only their heads out of water. Most specimens were found anywhere from a few feet to several yards from the water on higher, well drained banks or hillocks covered with grass or open brush. They habitually bask in the morning sun just out of the shadow of a small bush and when disturbed attempt to escape into holes opening among the roots of the bush. They are abundant in the marshy regions surrounding ponds and lakes.

Other races of the species feed on a large variety of food and I do not doubt that this race can do likewise. Nevertheless, all of the numerous food samples I have found in their stomachs have been either metamorphosed or unmetamorphosed frogs (*Rana aurora*). I believe this to be due largely to the abundance of frogs in the areas where most of the specimens were collected.

Records of *T. s. tetrataenia* and its intergrades (MVZ = Museum of Vertebrate Zoology, Berkeley, California; SNHM = Stanford Natural History Museum, Stanford, California; an asterisk indicates intergrades).—California.—*San Mateo County*: Skyline Blvd., 3 mi. S, (MVZ 3), 4½ mi. S (MVZ 170); 5½ mi. S of San Francisco County line (MVZ 39); hills W of San Bruno (SNHM 1); Laguna Salada, Sharp Park (MVZ 44); 1 mi. SE of Sharp Park (MVZ 10); 2 mi. N of Point Año Nuevo (MVZ 1); San Andreas Lake (MVZ 2, SNHM 9); Skyline Blvd., near Milbrae Highlands (MVZ 1); Crystal Lake (MVZ 1); Tanforan Rd., and Skyline Blvd. (SNHM 17); 5 mi. E La Honda (MVZ 1). *Santa Clara County*: Palo Alto (SNHM 4)*; Stanford University (SNHM 4)*.

Thamnophis sirtalis fitchi, nom. nov.

Eutaenia infernalis, Girard, 1858: 148.
Eutainia concinna, Lord, 1866: 306 (part).
Eutainia Pickeringii, Lord, 1866: (part).
Eutaenia sirtalis sirtalis, Cope, 1875: 41 (part).
Eutaenia sirtalis parietalis, Cope, 1875: 41 (part).
Eutaenia sirtalis obscura Cope, 1875: 41 (part).
Eutaenia sirtalis dorsalis, Cope, 1875: 41 (part).
Eutaenia sirtalis pickeringii, Cope, 1875: 41 (part).
Thamnophis sirtalis parietalis, Yarrow and Henshaw, 1878: 1638.
Tropidonotus sirtalis infernalis, Garman, 1883: 25 (part).
Eutaenia sirtalis, Townsend, 1887: 240.
Tropidonotus ordinatus var. *infernalis*, Boulenger, 1893: 207.
Thamnophis parietalis, Stejneger, 1893: 214.
Thamnophis sirtalis concinnus, Ruthven, 1908: 174 (part).
Thamnophis sirtalis infernalis, Van Denburgh and Slevin, 1918: 198 (part).
Thamnophis sirtalis tetrataenia, Fitch, 1941: 581.
Thamnophis ordinatus tetrataenia, Klauber, 1948: 10.

TYPE.—Adult female, MVZ No. 51778, collected at Greylodge Refuge, 9 mi. W of Gridley, Butte Co., California, by John Cowan.

RANGE.—The range of *T. s. fitchi* is the same as that described by Fitch (1941: 581 and Fig. 3) for the race he regarded as *T. s. tetrataenia,* namely, the great valleys of California between the coast ranges and the Sierras, but extending through the Sierras into western Nevada; reaching the coast only in northern Humboldt and Del Norte counties, California and southern Oregon; through eastern Oregon and Washington into Idaho and northward into British Columbia.

DIAGNOSIS.—A *Thamnophis sirtalis* in which the top of the head is black or very dark; the red and black colors of the sides of the body are arranged into an upper black stripe and a lower series of regularly spaced blotches which are continuous with the stripe dorsally and which are separated from each other laterally by regularly arranged red blotches; little or no black markings on the belly.

DESCRIPTION.—The snout is dark olive; the supralabials are pale olive and fade ventrally to cream yellow which continues over the infralabials and the throat. The throat color changes gradually posteriorly to yellowish gray and then to pale blue on the belly. Black markings are few on the belly and are mostly restricted to the anterior and lateral margins of the ventral scutes. The dorsal stripe is bright yellow or orange-yellow and occupies the mid-dorsal scale row and slightly more than half of each adjacent row. The lateral stripes occupy the second and most of the third scale rows. They are dull yellow. The dorsal ground color is black, causing the yellow stripes and red blotches to stand out sharply. The red blotches are regularly arranged on each side of the body. They are about 1 or 1¼ scale lengths in width and are separated by about the same distance. Their ventral margin lies on the upper half of the third scale row and may extend dorsally through the 4th, 5th or 6th scale row. The red pigment in this race occurs mostly on the interscale skin with relatively little on the scale surface as compared to *T. s. infernalis* in which the red blotches are much more pronounced.

There are usually 7 upper labials and 10 lower labials. Ventral scutes range from 156 to 177 in males and 151 to 172 in females; caudal scutes from 82 to 99 in males and 71 to 93 in females. There are nearly always 19–19–17 scale rows.

DESCRIPTION OF TYPE.—(Colors taken from the freshly killed specimen). Top of head, temporals and nuchals black; snout Dark Olive; sides of head through upper labials Deep Olive-Gray; central upper labials fade ventrally to Pale Glaucous-Blue; vertical black marks on the posterior margin of the sixth and seventh upper labials; anterior 8½ lower labials and throat Yellowish Glaucous; throat grades posteriorly into Pale Niagara Green in the neck to Pale Blue on the anterior belly and Light Glaucous-Blue on the posterior belly and the caudals. The anterior margin and lateral edges of ventral scutes with scattered black punctations; caudals appear grayish due to many scattered black dots. Lateral margin of the ventral scutes and lower half of first scale row Hair Brown; upper half of first scale row lighter gray. Greenish Glaucous-Blue of cheeks continuing posteriorly along the second scale row and lower half of third to Light Viridine Yellow and Viridine Yellow

of the lateral stripe which fades to Light Grayish Olive posteriorly. Dorsal stripe slightly over ½ + 1 + ½ scales wide, Empire Yellow anteriorly, Pale Chalcedony posteriorly. Areas between stripes black with series of regular Scarlet or Coral Red blotches on each side; blotches about one scale length in width, extend from the third to the sixth scale row anteriorly and the third to the fifth posteriorly. Red pigment occurs mostly on the interscale skin. Scale rows 19–19–17, ventrals 161, caudals 72+, upper labials 7–7, lower labials 10–10, preoculars 1–1, postoculars 4–4.

DISCUSSION.—This paper was not intended to serve as a review of the western races of *Thamnophis sirtalis*. Rather, its primary objective has been the elimination of some of the confusion which has existed in reference to the name "*tetrataenia*." However, having demonstrated that this name should be applied to the population of *Thamnophis sirtalis* which occupies the San Francisco peninsula, it has become necessary to supply another name for the race previously known as *T. s. tetrataenia*. Since, as far as I can determine, there is no available name for this race, I proposed that it be called *Thamnophis sirtalis fitchi* after Henry Fitch who recognized the validity of the race and described it fully and who has contributed so much to our understanding of the complex taxonomic relationships of the Pacific coast gartersnakes.

Fitch (1941: 582–84) has already discussed the relationships of *T. s. fitchi* under the name of *T. s. tetrataenia*. Since I have little new information to add to his discussion, I shall not pursue the subject further at this time. Actually, this race definitely needs further examination, especially in the northern and eastern parts of its range from which few specimens are known.

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DEPT. OF ZOOLOGY, UNIV. OF SO. CALIFORNIA, LOS ANGELES, CAL.

Rediscovery of the Broad-headed Frog, *Eleutherodactylus laticeps* (Duméril), of Mexico

I. Lester Firschein

In 1853, Auguste Duméril described a "large tête" *Hylodes laticeps* from "Yucatan" in Central America, the unique representative of which was secured by Pierre Marie Arthur Morelet during his sojourn in southern México and Central America in 1847 and 1848. The species was not rediscovered until more than one hundred years later when Dr. and Mrs. Clarence Goodnight found a specimen in the foothills of the Chiapan highlands at the Palenque Ruins, Chiapas. In the meantime numerous errors have been committed in allocating and characterizing the species. The present account is an attempt to rectify these errors and re-diagnose the species.

Eleutherodactylus laticeps (Duméril)

Hylodes laticeps Duméril, Ann. Sci. Nat. Paris, ser. 3, zool., vol. 19, 1853, p. 179.—Duméril, Bibron and Duméril, Erpétologie générale, vol. 9, 1854, p. 408, Atlas, pl. 99, figs. 1–4.—Dugès, La Naturaleza, vol. 1, 1869, p. 19.—Boulenger, Catalogue of the Batrachia Salientia s. Ecaudata in the collection of the British Museum, 2nd. ed. 1882, p. 210. (The Tehuantepec and Guanajuato locality citations apparently have no factual basis.)—Brocchi, Mission scientifique au Mexique et dans l'Amérique Centrale, pt. 3, sect. 2, livr. 1, 1881, p. 49–50.

Eleutherodactylus laticeps Kellogg, U. S. Nat. Mus. Bull. 160, 1932, pp. 93, 106–107.—Smith and Taylor, U. S. Nat. Mus. Bull. 194, 1948, pp. 59, 63. (The species does not "run down" properly in Smith and Taylor's key. Couplet 8 states that no trace of an inner tarsal fold exists, whereas *E. laticeps* does possess one. The species would be referred to the *rugulosus* group by following the key literally.)

Material Examined.—The following five specimens were available for study and comparison. Guibé's notes on the type of *E. laticeps* and also his measurements were incorporated in this account. As far as known there are no other representatives of this group in any European or American institutions. *E. laticeps*. Univ. Ill. Mus. Nat. Hist., No. 11301, Palenque Ruins, Chiapas, collected at night while wandering on the forest floor, by C. G. Goodnight; Mus. Nat. d'Hist. Nat. Paris, No. 509, "Yucatan," Central America, collected by Morelet. *E. stantoni*. Mus. Zool. Univ. Mich., No. 90958, Finca Chichén, Alta Verapaz, Guatemala, collected by L. C. Stuart on the ground in the cloud forest at 1600 meters; Mus. Zool. Univ. Mich., Nos. 80673 (type), 80672 (paratype), Valentin, British Honduras, collected by C. L. Lundell.

Type Locality.—Originally stated as Yucatán, Central America, here restricted to Champotón, Campeche. The actual place of collection remains a mystery and probably will never be accurately known. According to Guibé, Morelet visited several localities on the peninsula of Yucatán, namely: Carmen Island, Champotón, Jequelchacan, Campeche, Kopoma and Mérida. The specimen seems much more likely to have been taken in the forested regions around Champoton, rather than at localities in the semi-xeric areas that prevail in or adjacent to the vicinities of Mérida, Campeche, Carmen Island and Kopoma. Jequelchacan has not been located on the maps of this region.

DIAGNOSIS.—An *Eleutherodactylus* belonging to an undescribed group, here called the *laticeps* group (containing also *E. stantoni* Schmidt and perhaps others), distinguished by the presence of a transverse scapular fold, roughened skin texture dorsally, shorter fore and hind limbs, and a different color pattern.

DESCRIPTION (based chiefly upon the Palenque specimen).—Head slightly wider than body, noticeably wider than head length; nostrils almost terminal; snout obtuse; canthus rostralis distinct, sharp, loreal area sloping slightly to jaw margin; tympanum oval, vertical diameter about half of eye; tongue oval, broad; vomerine teeth patches oblique, slightly to rear of posterior borders of choanae and medial to their inner margin. Arms short, finger tips barely reaching snout when arm is stretched forward; digital disks of fingers and toes small, not expanded; second finger smaller than first and with terminal digital disk distinctly smaller than on any other finger; third finger longest; fingers free of webbing; slight vestigial web present at base of toes; inner metatarsal tubercle high and elongate, outer small and round, less than one half as large as inner; sub-articular tubercles at base of metapodials large; metatarsal supernumerary tubercles few; no plantar series of tubercles; palmar tubercles large, prominent; an elongate thenar tubercle at base of thumb, flanked laterally by a small conical tubercle; median palmar tubercle split for more than half its length; inner tarsal fold sharp-edged, high, extending from base of inner metatarsal tubercle for more than half length of tarsus; heels overlapping several millimeters when legs folded; tibio-tarsal articulation reaching a point half way between eye and nostril when leg is extended forward.

The skin texture of *E. laticeps* may be described as shagreened, or as a reticular network of fine grooves enclosing irregular areas, especially noticeable in occipital region; top of head anterior to eye, smooth; undersurface of thigh finely granulated posteriorly; venter smooth; well defined supratympanic fold, edged with black, extending over and behind margin of tympanum; another secondary, well defined, raised cutaneous fold running from supratympanic fold along sides of body almost to inguinal region; a transverse ridge (scapular fold) traversing shoulder region between insertion of arms.

The dorsal coloration gray-brown in alcohol although in life, according to the collector, it was grayish-green above; venter white, with sparse spotting of brown on lateral areas of throat; areas immediately lateral to outer margins of ventral disk, gray-brown, with but a slight indication of spotting on posterior ventrolateral portions; no posterior thigh reticulation, rather a washed brown area of small maculations on anteroventral surface of thigh; wide transverse dark bar on anteroventral and posteroventral portions of tibia; upper surface of legs faintly barred; under surfaces of tarsus and foot black; black stripe on underside of antibrachium, extending along outer margin of palm to base of fifth finger; anterolateral surface of antibrachium marked with a squarish black area; lower margin of upper jaw with indistinct white line bordered below by a very thin narrow line flanking the jaw margin itself; upper loreal region dark; a stripe, extending from nostril through eye and following supratympanic fold above the tympanum, reaches a point

behind and on line with lower edge of tympanum; tympanum brownish; dorsal pattern of body obscured by ground color but very faint lines may be discerned beginning at posterior corner of upper eyelid and converging at midline half way down length of body, then passing posteriorly as they diverge for a short distance toward sides; this pattern produces a large "X" with the lower pinion much shorter in extent than the upper.

MEASUREMENTS (in mm.).—To avoid repetition of characters, measurements are given for both *E. laticeps* and *E. stantoni*, with which comparisons are necessary. For *E. laticeps* (MHNP No. 509; UIMNH No. 11301) and *E. stantoni* (UMMZ Nos. 80673, 80672, 90958), the measurements are, respectively: snout-to-vent 72.0, 71.4, 52, 53, 63.1; head length 28.0, 27.1, 22, 22.8, 25.0; head width 34, 31.4, 22, 23, 28.4; tarsus plus foot - - -, 48.4, 43.8, 42.7, 45.7; foot 33.5, 32.6, - - -, - - -, 33.5; tympanum 4.7, 5.4 (vertical), - - -, - - -, 4.8 (vertical) and 4.3 (horizontal); interorbital distance 7.4, 8.6, - - -, - - -, 7.8; intertympanic distance 25, 24.2, - - -, - - -, 22.0; eye 8.5, 8.2, - - -, - - -, 7.6; eye-lid width 7.5, 5.0, - - -, - - -, 5.1; eye to nostril 9.7, 9.5, - - -, - - -, 8.1.

SPECIFIC DETERMINATION.—A number of disparities exist between the preceding description and previous accounts of the type of *E. laticeps*, and these must be accounted for.

Günther (1901: 235) stated that the toes are free and called Boulenger (1882: 210) to task for inserting without basis into his description "toes webbed at base" whereas Duméril had originally described the toes as free. Brocchi (1883: 50) also described the toes as possessing a rudimentary membrane as did Kellogg in his redescription of the type. The figure of the type, according to Günther, shows toes without rudiments of a web. Actually the drawing portrays this feature very poorly and, accordingly, at the present time the exact extent of webbing in the type remains uncertain.

The skin above and below is smooth, according to the type description, but Kellogg reported it to be of shagreened texture as in the Chiapan specimen. Dr. Guibé informs me that in his opinion the dorsal integument in the type is finely granulated but with no indication of a squamous network in the occipital region as shown in the photograph supplied of the Palenque individual (Plate I, Fig. A). The significance of any difference of this minor character is questionable, however, in view of the possible alteration resulting from over one-hundred years of preservation.

Dorsolateral folds running the length of the body were stated by Schmidt (1941: 484) to be absent in the type, but actually they are present as verified by Dr. Guibé, who reports that there is a secondary fold branching from the supratympanic fold and extending laterally along the body almost to the inguinal region.

The tympanum in the type is said by Schmidt to be "nearly as large as eye," but as the preceding measurements show, it is only a little more than half the diameter of the eye in both known specimens.

The canthus rostralis is indicated as rounded, by Kellogg (1932: 93), but it appears rather sharp and well defined in the figure of the type and Dr. Guibé confirms this impression.

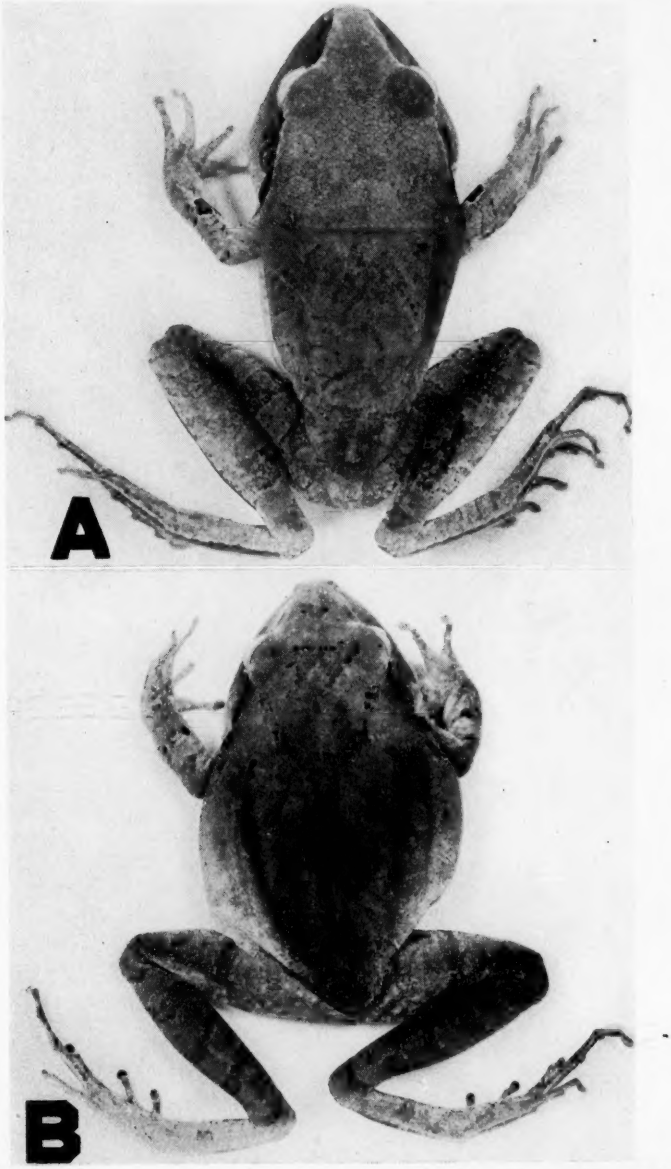

Fig. A. *Eleutherodactylus laticeps* (Duméril). UIMNH No. 11301, Palenque Ruins, Chiapas.

Fig. B. *Eleutherodactylus stantoni* Schmidt. UMMZ No. 90958, Finca Chichen, Alta Verapaz, Guatemala.

In the above and in all other prospects of any possible significance, the type of *E. laticeps* and the Palenque specimen appear to be in agreement.

COMPARISONS.—A unique character in this species is apparently a transverse scapular fold. This was termed a post-tympanic fold by Kellogg but the name is easily confused, as it has been by some, with the intertympanic fold of more common occurrence among certain eleutherodactylids. As a matter of fact so unusual is this fold that on the basis of a single specimen one might reasonably suspect, as has been done, that either the normal intertympanic fold was erroneously placed in the original figure (Duméril, Bibron and Duméril, 1854: Atlas: pl. 99) or that the ridge was an anomaly or artifact. Guibé, however, has kindly verified its position on the type as illustrated and its occurrence also on the Palenque specimen precludes the assumption of an anomaly or artifact.

Despite this difference *E. stantoni* clearly is closely related to *E. laticeps*. It differs otherwise in possessing longer hind legs (tibio-tarsal articulation reaching snout or farther), longer forelegs (tip of digits extending beyond snout), and in various features of color and pattern.

Direct comparison has also been made between Stuart's Alta Verapaz specimen (Plate I, Fig. B) and the type of *E. stantoni* from British Honduras. I agree essentially with Stuart that the Guatemalan specimen probably represents this species. However certain inconsistencies between Schmidt's description of the type of *E. stantoni* and this specimen are apparent. The skin of the back and upper surface of the tibia is finely and uniformly rugose, according to Schmidt, whereas in the Alta Verapaz specimen the skin is more nearly smooth. In the type and also the paratype, the tympanum measurement equals that of the eye, but in the Alta Verapaz specimen neither the vertical nor the horizontal diameters of the tympanum equals more than three-quarters the eye. The dorsal pattern of this specimen is more strongly marked and darker than the background than in the Chiapan *E. laticeps*. Stuart (1948: 25) records that in life the Alta Verapaz specimen was reddish brown above with an irregular "×" mark on the back, a dark band across the snout and one in the interorbital region (the latter band actually forms the base of a dark triangle). There was no mention of a dorsal pattern in the type description of *E. stantoni* except "grayish-brown above"; however, one can discern an "×" mark consisting of low tubercles on the back of the specimen. Notwithstanding these differences it does appear that, for the moment, these specimens may well be considered as the same species, with some reservation that future specimens from highland areas in Guatemala may show such consistently distinct differences from those of British Honduras that a separation may be warranted.

GROUP ALLOCATION.—*E. laticeps* was, on the basis of the very incomplete evidence then available, placed by Taylor (1939, 1940, 1942) in a group with *E. cactorum, latrans, augusti, bolivari* and *tarahumaraensis*. Information now at hand removes *E. laticeps* from that group (which unfortunately bore its name). This distinct autonomous group is here re-designated the *augusti* group which is restricted, so far as now known, to the main plateau of México and its northward extensions. The characters of the *augusti* group are: an intertympanic transverse fold (except in *E. tarahumaraensis*),

bufonid habitus, a strongly defined ventral disk, large supernumerary tubercles on soles and palms, tips of fingers and toes bulbous with no transverse grooves present at tips, canthus rostralis rounded, and dorsal color pattern consisting of a series of light-bordered dark blotches.

The group containing *E. laticeps* and *E. stantoni* is apparently not only markedly different from the *augusti* group but also from all other known groups of the genus in México and Guatemala. It is accordingly here designated the *laticeps* group and may be characterized as follows: habitus raniform, not toadlike; head much wider than body; abdominal disk well formed, with entire margin raised; webbing not entirely absent, but vestigial; terminal disks of fingers and toes scarcely wider than digits themselves; tips not bulbous but distinctly flattened and with a transverse groove present on extreme outer margin at junction of superior and inferior surfaces of pad; canthus rostralis distinctly sharp; loreal region sloping gently to base of upper lip; markings on dorsum cruciform; legs banded.

In both the *laticeps* and the *augusti* groups and also some members of other eleutherodactylid groups, the head is extremely broad in adults. This feature is, however, an allometric one; the ratio of head-length to head-width increases as the total length increases. This character cannot be utilized as a group one, since immature individuals cannot be accurately placed on this basis.

No other group of eleutherodactylids in México or Guatemala is apparently closely related, but superficially the *rugulosus* group is similar in appearance.

Geography of the Laticeps Group.—The members of the *laticeps* complex form a closely knit, geographically representative group which ranges through several "biotic" provinces (Smith, 1949). The type locality (restricted) of *E. laticeps* and that of *E. stantoni* both fall within the Peten Province. The "high tropical rain-forest with mixed savanna conditions," which Smith regarded as characteristic of the province, does not strictly apply to the general area of the type locality of *E. stantoni,* which includes pine mixed with the so-called "Cohune ridge" vegetation and savanna. The Chiapan *E. laticeps,* from the lower humid foothills of the southern highlands where the Palenque Ruins are located, is within the area designated as the Palenque Province by Smith or the Tabascan District of Brodkorb (1943). The Guatemalan *E. stantoni* is from Stuart's (1943, 1950) Quecchian faunal area (termed a biotic province by Smith). These three "biotic provinces" are inhabited more or less indiscriminately by the two species.

In general the trend of the Caribbean lowland fauna is toward highland invasion, as shown by the faunistic stock of upland regions such as Alta Verapaz (Quecchian area). It is strange indeed that local differentiation is not more apparent in this particular highland segment of the Guatemalan Plateau.

The kind of endemism that does occur in these areas, especially in the highland area whose faunal assemblage is closely allied to that of the Petén faunal area, is one of subspecies and of "complement" or "geographic replacement" of species from the lowland species complexes. (The specimen of *E. stantoni* from the highland area may actually represent a "complement"

form, since differences are apparent between this specimen and the lowland types). In many reptilian and amphibian groups of lowland affinities, species and superspecies components include a highland representative. This shows to some extent that there is a faunistic discontinuity between the highland and Caribbean lowland. Whether even this kind of break justifies the concept of biotic provinces in areas that show so little unique speciation, is dubious. Recognition of such divisions for the lowland areas is even more questionable.

The utility of geographically representative species and races as indices of faunistic homogeniety within an area requires further examination. Until some workable formula appears, I prefer to utilize, as did Stuart (*op. cit.*), the very innocuous and nearly meaningless term "faunal area" for the supposedly biogeographically distinctive areas of this region.

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MUSEUM OF NATURAL HISTORY, UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS.

Remarks on the Status of the Lizard *Eremias olivieri* Audouin

GEORGE HAAS

IN HIS discussion of *Eremias guttulata*, Boulenger (1921: 258–71) separated the *forma typica* from five other varieties; the typical form is characterized by having the transparent disc of the lower eyelid composed of 2 large, usually black-edged scales, while in the other varieties the disc is opaque or more or less transparent and is composed of 3 to 8 pieces which are not black-edged.

The original description of Audouin's *Lacerta olivieri* gives the figures of two forms, of which, according to Boulenger's nomenclature, one is the typical form, *Eremias guttulata*, and the other is *E. guttulata* var. *olivieri*.

As these specimens were collected during Napoleon's campaign in Egypt, and no locality is given, they both could have come from Egypt, Sinai or Palestine. The "variety" has a non-ocellated, rather striped pattern, and one of the drawings shows, in contrast to the typical form, *strongly keeled ventral scales at the root of the tail.*

After having seen the different varieties of *E. guttulata* in the collections of the British Museum of Natural History and having at my disposal a rather considerable series of *guttulata* and *olivieri* from Palestine, the following facts seem worthwhile to be stressed. (1) In Boulenger's arrangement of the different groups of *guttulata* priority is given to the scutellation of the lower eyelid. (2) In Palestine, the local *olivieri* and *guttulata* are quite different morphologically as well as in their habitat, *olivieri* preferring open ground, *guttulata* more rocky to gravel-covered ground. In the first form, the young has a striated pattern, like the young of *Ophisops elegans;* in the second the young already shows an ocellated pattern. Nevertheless, this color pattern in *guttulata* is regionally rather faint, and faintly ocellated color phases of adults of *olivieri* are known as well as normal striated ones. Locally, a certain over-lapping of both forms may occur, but one or the other occurs exclusively in many areas. (3) Specimens of *olivieri* from Sinai and Palestine differ in several characters from all specimens west of the Nile Valley. Out of 36 specimens of *olivieri* from Palestine, ten had 4–4 supralabials in front of the subocular, five had 5–4, twenty had 5–5 and one had 5–6. The higher scale counts occur, therefore, in a ratio of 26:10. A similar statistic for 163 specimens of *guttulata* shows that two had 3–3 supralabials in front of the subocular, six had 3–4, and 142 had 4–4, while twelve had 4–5, and seven had 5–5. Here the higher scale counts occur in a ratio of 19:150.

The peak of the variation lies at the lower number for *guttulata,* at the higher number for *olivieri* from Palestine. I did not find this percentage of the labial number in *olivieri* from the west of the Nile Valley. The geographical distribution of *olivieri* is of special interest. It is recorded from Rio de Oro (Spanish Sahara) eastward along the northern border of the Mediterranean to Tunisia; then there seems to be a gap and it is found again in Sinai. Egypt, or at least the Nile Valley, separates an eastern group of *olivieri* from the western group. East of the Nile, *olivieri* occurs as var. *martini* and as typical *olivieri* again in British Somaliland. From Egypt, only the typical form seems to be known.

In *olivieri* from Sinai and Palestine, the ventral scales of the tail are strongly keeled; they are not in the specimens west of the Nile Valley and in Somaliland. The keel starts a little farther back in fullgrown males, probably in connection with the swelling of the root of the tail which harbors the retracted hemipenes. Owing to this scutellation the base of the tail is rounded and not slightly flattened as in the smooth-scaled forms.

In the northeastern group the ventral tibial scales are arranged as a norm in four transversal series; in *guttulata* as well as in western *olivieri,* three series only are present as a rule. In counting these I start with the biggest proximal series, neglecting irregular, slightly enlarged scales in front of this very well developed one, and I end at the border of the very small dorsal scales which start abruptly.

The tail in Palestinian-Sinai specimens is of a rich yellow color. Specimens of *guttulata* from this area never show this striking feature. The rather old, alcoholic specimens of *olivieri* in the British Museum from the western area no longer show this striking feature, nor do the rather fresh specimens from British Somaliland.

All the other designated varieties of *Eremias guttulata,* viz., *martini* from the Red Sea shores, *latasti* from Aumale (Algiers), *susana* from Susa (Tunisia), and, in a lesser degree, *balfouri* from Socotra seem to be subspecies of *olivieri.*

There is no doubt that *olivieri* should be elevated to the rank of a full species. The subdivided palpebral disc, the stouter proportions of the snout, and the character of coloration distinguish it well from *guttulata,* which has, no doubt, its geographical races as well (ranging from Sind in the East, through Baluchistan, Persia, through Palestine and Egypt to Oran, including regions as distant as South Arabia and Transcaspia).

For the Palestinian form I propose the name,

Eremias olivieri schmidti, subsp. nov.

TYPE.—Hebrew University No. 1765, male, from Wadi Nefkh; December 11, 1949.

PARATYPES.—HU No. 1766, male, from Sahl el Hawa; October 16, 1949. HU No. 1762, female, from Hathrura-Zuweira; October 25, 1949. HU No. 1764, female, from Revivim; September 30, 1949. Eight other specimens from various parts of southern Israel.

DIAGNOSIS.—Usually 5 supralabials in front of subocular; 4 series of enlarged subtibial scales; ventral side of distal portion of tail with keeled scales; ventral surface of tail yellow.

Eremias o. olivieri is characterized by having 4 supralabials in front of the subocular; 3 series of enlarged subtibial scales; and the scales of the ventral side of the distal portion of the tail are smooth. This subspecies occupies the region west of the Nile Valley as well as Somaliland (provisionally).

The other varieties of Boulenger (*op. cit.*) should be recognized as subspecies of *E. olivieri.* In this series the insular form from Socotra is quite as extreme as *E. o. schmidti,* whereas the others show only gradual differences from *E. o. olivieri. Eremias o. balfouri,* with the lower eyelid as in all the other subspecies, has the rather pointed snout of *E. guttulata.* We know almost nothing about the populations from the Arabian Peninsula except from the extreme south. There are no data available for *E. o. schmidti* from Iraq, *E. guttulata* only being known from there (Schmidt, 1939).

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HEBREW UNIVERSITY, JERUSALEM, ISRAEL.

The Locomotor Behavior of Spinal Elasmobranchs with an Analysis of Stinging in *Urobatis*[1]

BERRY CAMPBELL

THE undulatory swimming pattern is as fundamental in the make-up of the members of the phylum Chordata as the possession of a flexible notochord. This swimming behavior is exhibited, in a simple or as a derived pattern, by all forms with the exception of the sessile adult ascidians. The interdependence of these two basic features has been suggested and ably supported by de Lange (1936), whose discussion of the morphology of the chordates emphasizes the relation of the body column and its associated metameric musculature to swimming. According to this interpretation, the segmented effector (muscle) system arranged along the semi-rigid notochord serves the primitive or "Urtyp" locomotion. The phylogeny of the locomotor behavior should be related to the evolutionary history of the skeletal framework, its associated musculature and to the neural integrative apparatus to achieve the full picture of evolution within the phylum.

The nervous structures which integrate this behavior are nowhere more revealingly discussed than in Coghill's (1929) treatise. This author has shown that the appearance of sinuous swimming and of longitudinally conducting motor-cell columns in the spinal cord, in the early *Ambystoma* larva, go hand in hand. This has been amply substantiated by other authors. In the work of Coghill and his collaborators we find a careful tracing of this simple behavior system as it is modified by the developing sensory systems, the growth of limbs, of jaws and gills, and progressive encephalization. Teleosts, amphibians, birds and mammals are all considered. The various papers of this school are discussed and listed in Herrick (1949).

In a previous paper (Campbell, 1940), I have discussed the undulatory swimming behavior of hagfish with intact and transected spinal cords. It was shown that the integrative mechanisms involved were spinal, not cerebral, though the brain influenced quantitatively the locomotor response and integrated it with the environment (righting reflexes, for example). Conditions governing the forward and backward motion of the undulatory waves were explored and the effects of partial section of the spinal cord described. It was shown that immediately upon separation, an isolated portion of the spinal cord acts as a whole, establishing a head and tail end with rather different properties and that the wave length of the undulations adjusts immediately downward as the spinal cord is rendered shorter.

The pelagic sharks, as Gray and Sand (1936) have pointed out, utilize a purely undulatory type of swimming. The resemblance between the progression of these animals and that of the hagfish is striking. Yet certain complications have occurred in the swimming sharks. The development of jaws and of other specialized structures has enlarged the head to a considerable proportion of the entire body length and thus has removed much of the

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anterior region of the animals from the locomotor apparatus. The body has become relatively shorter and more rigid as compared with the cyclostomes. The development of paired fins has broken the otherwise uniform succession of myomeres and presumably complicated the structure of the spinal cord at the pectoral and pelvic levels. In addition, the assumption of internal fertilization has resulted in the superimposition of a copulatory pattern upon the trunk and tail behavior in both sexes and has led to the fractionation, in the male, of the pelvic fin into locomotor and copulatory parts. Though there are no outward signs of copulatory specialization in the female shark, the spinal cord is the common organ of integration of both swimming and sexual behavior.

The Batoidei (skates and rays) as well as certain true sharks (Selachoidei) have abandoned the basic simplicity of shark locomotion by utilizing the pectoral fins as propellent organs. This has introduced a radically new behavior pattern. The pectoral fins do not differentiate, in their function, from the trunk in the way that such differentiation is known in the tetrapods. Coghill (1929) has shown the ontogenetic sequence by which the pattern of limb activity from its inception is integrated within the undulatory behavior pattern in the salamander larva. In discussing the relation of stepping behavior to swimming, Gray (1933) and Gray and Sand (1936) have suggested that limb locomotion is a specialization of the basic undulatory pattern. This relationship is obvious in most tetrapods, though exceptions do occur. Within the elasmobranchs, however, a wide range of replacement of the fundamental chordate type of sinuous swimming by a pectoral fin propulsion has occurred. This pattern is peculiar to the group. The phylogenetic sequence in which the present locomotor behavior patterns have been established has recently been questioned by White (1937) in her elaborate and valuable monograph on the phylogeny of the elasmobranch fishes.

The present report concerns the variations in the swimming behavior within the Elasmobranchii. The representative group studied included members of the Selachoidei (sharks) and of the Batoidei (skates and rays), and the following species were represented: *Mustelus californicus* Gill—the gray smoothhound, *Rhinobatos productus* (Ayres)—the shovelnose guitarfish, *Zapteryx exasperata* (Jordan and Gilbert)—the mottled guitarfish, *Urobatis halleri* (Cooper)—the round stingray, *Gymnura marmorata* (Cooper)—the butterfly stingray, and *Holorhinus californicus* (Gill)—the bat stingray. In addition, five 56-mm. embryos of *Mustelus californicus*, delivered prematurely in the aquarium, were available for study.

Methods

The elasmobranchs utilized in the present study were brought in after capture by seining, trawling, or spearing and placed in a large aquarium tank. Observations on the spontaneous locomotion and on the responses to various stimuli were made on the intact specimens. The animals then were removed and subjected to spinal-cord section immediately behind the head. In some, additional sections were made at more caudal levels. All of the fishes so treated were returned to the aquarium and kept for periods of from 2 to 4

weeks. No difficulty was encountered in maintaining any of the animals except for the exhaustion and multiple abrasion suffered by the *Mustelus californicus*.

Findings

Mustelus californicus (Fig. 1,A) was the only representative of the typical free-swimming sharks used in this study. The locomotor pattern of the intact fish was as described by numerous authors, a simple undulatory progression, not greatly complicated by the fins. Cutting the spinal cord de-

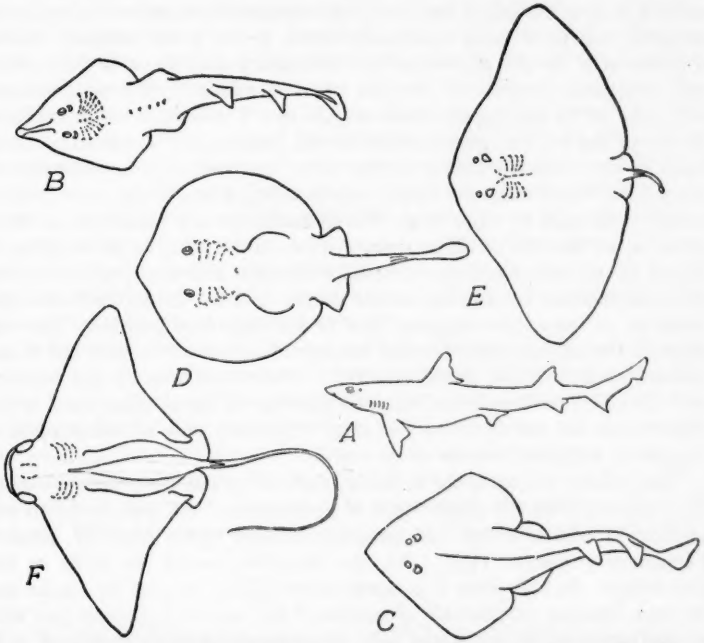

Fig. 1. Sketches showing body form of species studied. A. *Mustelus californicus*, B. *Rhinobatos productus*, C. *Zapteryx exasperata*, D. *Urobatis halleri*, E. *Gymnura marmorata*, F. *Holorhinus californicus*. After Roedel and Ripley (1950), courtesy of California Division of Fish and Game.

creased the speed of the wave motion and made automatic the activity which was normally oriented in relation to the physical environment and to the investigator. This was best shown, as previously reported by Gray and Sand (1936), when the spinal fish was supported in midwater in the aquarium. Incessant slow swimming motions were then exhibited. If the spinal preparation was allowed to rest on the bottom of the tank, it frequently showed a weak but perceptible undulation, at other times none. When suspended, so that strong undulatory waves were present, pinching the tail augmented the activity. On the other hand, grasping the forward part of the trunk allowed the observer to inhibit all wave activity. This agrees closely with observa-

tions, reported previously, on the hagfish, where not only inhibition of normal undulations but the initiation of reverse waves followed stimulation of the gill region. In the adult shark, however, reversing was not induced.

The basic locomotor pattern of this species was lucidly demonstrated in the embryos. A number of different patterns were observed, all of them surprisingly similar to those described by Coghill (1929) in *Ambystoma* larvae. The characteristic activity of the undisturbed embryo (placed in a finger bowl containing sea water) was an incessant swimming type of undulation. Because of the great flexibility of the body, the curves were much more marked than in the adult, but the actual number of waves was the same—a complete sine wave being constantly visible in the active animal. Tactile stimulation of the tail augmented this undulatory activity or, if the embryo were motionless, initiated it. Reversal could be induced by stimulation of the gill region or by tapping the cordlike yolk sac. The reverse waves began at the tip of the tail and progressed along the body axis to the head. Several times it was observed that a reverse wave, unopposed by a contralateral contraction, would cause the entire body to roll up into a circle. This posture tended to be held for some time. The phenomenon is probably to be interpreted as an instance of the stationary waves as described in the hagfish. A variant of this coiling activity, identical with motor activity described in very young salamander larvae, was similar coiling to a full circle which was followed by an immediate snapping back to a straightened position. This was observed several times where coiling was repetitive and to one side, and in one instance where alternate coiling occurred. The motive force for the recovery from the coiled position is obviously the elasticity of the notochord and of the other tissues and not an active posturing. The coils may be looked upon as unopposed unilateral waves of contraction.

The series of species of the Batoidei available for this study showed clearly the transition from the pelagic type of locomotion of the true sharks to one adapted to bottom living (picturesquely dubbed "grovelling" by White). *Rhinobatos productus* (Fig. 1,B), the guitarfish, served for many of the observations. In body form it is exactly intermediate between the sharks and the rays, showing considerable expansion of the head and pectoral fins with no diminution of the trunk and tail. Its swimming pattern shows not only the sinuous undulations of the trunk and tail but also a pectoral fin component quite unrelated to it. In this latter behavior pattern, bilateral waves of extension (dorsal muculature) and flexion (ventral musculature) pass along the borders of the fins. Thus the swimming may still be considered as undulatory, though the nervous integration is entirely of a different sort and is mediated principally by the cranial nerves. The mechanical efficacy of this locomotion is apparent in those fish with their brains and spinal cords severed. Swimming with the pectorals only was rapid and well directed. In the same operated individuals, when the head segment was quiescent, effective locomotion was accomplished with the trunk and tail using the shark-like undulatory pattern. We may conclude, from the independence of these two locomotor patterns in the intermediate elasmobranchs, that the pectoral locomotion is *sui generis* in the Batoidei and that its derivation has not been from the spinally integrated basic swimming pattern. It seems likely that the origin

of this behavior is to be looked for in an ancestral gill motor pattern.

Attention in this series of observations was directed mainly toward the undulatory swimming behavior pattern. In the guitarfish, severance of the spinal cord near the head caused little alteration of this behavior other than the environmental dissociation attributable to the loss of labyrinths, eyes, and other sensory organs of the head. The spinal segment showed a caudal predominance of the same nature, but more marked, than that apparent in the spinal hagfish. In the latter form, the head and tail end of the spinal segment each served as sites for the induction of undulation. Stimulation of the head end caused reverse waves, of the tail end normal waves. Quantitatively the two ends varied in threshhold and in the size of the effective reflexogenous area. It took a much lighter stimulus on the tail end to evoke the activity, and the effective area was perhaps ten times as large. In the guitarfish, the same polarity was to be seen. Tactile stimulation on the caudal two-thirds of the spinal segment (including the tail, dorsal and pelvic fins, and the region of the cloaca) caused normal swimming. Only a small area on the dorsum of the trunk had a contrary function. Strong stimulation at this point would inhibit normal undulation but never, in my experiments, induced reversal. (For a special instance, see below in discussion of "stinging" behavior of the rays.) The failure to obtain reversal was not due to an absence of that behavior pattern, for the intact animal when grasped by the rostrum showed vigorous backward swimming.

An important feature of the integrative apparatus of the hagfish was described with the observations on isolated fragments of the body axis. No matter what part of the fish was isolated, the caudal end of the separate portion showed the lowest threshhold to tactile stimulation and the largest area which induced normal undulations. The same phenomenon is to be seen in the elasmobranch as shown in the following experiment on the guitarfish, *Zapteryx exasperata* (Fig. 2). The spinal cord was sectioned close to the head. Later a second section was made across the spinal cord immediately

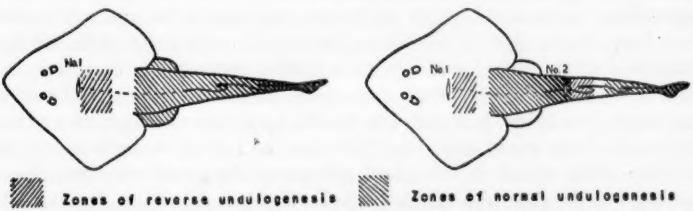

Fig. 2. Illustration of pattern of undulogenic zones in *Zapteryx exasperata* after a single high spinal section, left, and after an additional mid-spinal section, right. The borders of the skin zones fall a short distance behind the second spinal section because of the obliquity of the spinal nerves.

anterior to the first dorsal fin. The area in which this section was placed had, previous to the operation, been within the area evoking normal undulations, though the threshhold was much higher than on the tail. Immediate changes in the behavior evoked by stimulation of the skin in this area were noted after the section. The area innervated by nerves from the tail segment no

longer served to induce undulation. If swimming of the tail segment were caused by pinching the tail fin, stimulation of the area of the first dorsal fin inhibited this motion. This means that a part of the spinal cord lying in the functional tail end of a large segment had acquired the properties of a head end when a spinal section left it the rostral end of a shorter segment. Related change was to be seen in the integrative meaning of stimulation of the skin innervated by the caudalmost nerves of the trunk segment. This area, which had previously been undulogenic with a high threshhold, became exquisitely sensitive, every slight touch evoking normal undulations in the trunk segment.

So clearly did the elasmobranch spinal cord exhibit the same functional plasticity as that of the hagfish that experiments were performed to test the relation of wave length to length of the spinal segment. In the cyclostome, the wave length became progressively shorter as the cord length was reduced, a phenomenon first observed by Thorner (1932) in similar experiments on snakes. The greater rigidity of the elasmobranchs made observation of the wave pattern of short segments difficult and success in demonstrating the phenomenon was had only with the caudal ends of the fish. In both *Mustelus* and *Rhinobatos* the wave pattern showed progressive shortening as the spinal segment was decreased in length.

The sting ray, *Urobatis halleri* (Fig. 1,D) is, in the series studied, a step more removed from the typical sharks in that the pectoral fins are proportionately larger while the tail and trunk are smaller than in the guitarfish. Intact specimens of this form used the trunk very little in swimming, progression being effected nearly entirely by the bilateral vertical undulations of the pectoral fins, as described above. The principal feature of interest in this species is the specialized trunk behavior which is related to the stinging organ. Though this fish is greatly feared by bathers, in the aquarium it proved very reluctant to sting. Many kinds of noxius stimuli failed to evoke the stinging, but success was finally had by pinning the fish to the bottom of the tank by the sudden application of a large rubber suction disc on the end of a stick. This caused repeated thrusts with the stinging spine. Other stimuli induced only a flight response. Analysis of the reaction pattern became much easier when it was found that a complete release of this performance followed high transection of the spinal cord. In such divided animals, no flight response could be elicited by stimulation of the body posterior to the spinal section. The stinging reaction, however, was revoked by each stimulus to a rather large area of the spinal segment. There was no loss in strength nor in the accuracy of the thrust in the spinal animals as compared with their intact controls, but the ease with which the behavior was evoked was increased by a surprising amount.

The stinging reaction of the spinal animal follows stimulation of the caudal one-third of the pectoral fins, which are innervated by the spinal segment, and by the whole of the surface of the pelvic fins. No response followed the same or greater stimulation of the trunk. The stinging was always directed to the side. That it is a derivative of the reverse undulatory pattern is shown by two types of evidence. A careful visual and cinematic analysis of the action revealed an ipsilateral (to the evoking stimulus) bending of the tail (Fig. 3,A). This starts at the region of the sting and progresses forward.

The sting is thus brought toward the offending stimulus. Then, while the tail is held in a sharp curve, a contralateral contraction high on the trunk draws the stinger back (Fig. 3,B) and an ipsilateral contraction quickly jabs it to a point in space a short distance above the stimulus (Fig. 3,C).

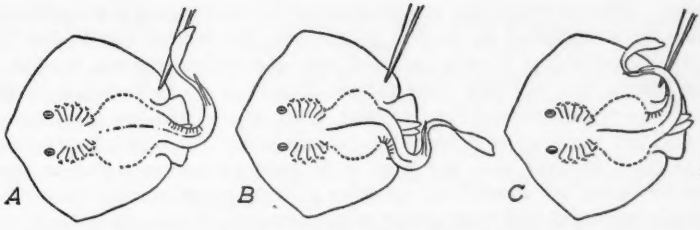

Fig. 3. Sketches from movie of stinging act of *Urobatis halleri*. For explanation of sequence, see text.

The tip end of the tail takes no part in this action. Substantiation of the interpretation of the stinging reaction as reverse undulation is found also in the fact that pinching the tail or otherwise stimulating it completely inhibits the stinging pattern. The tail dominance of the spinal segment inhibits a derived reversing pattern in a way quite in keeping with the observations detailed above and presented earlier in the study of the hagfish.

Two phyletic trends seem to have followed the evolution of the pectoral swimming pattern. One has led to a progressive loss of motility and a strict bottom living habitus. This "grovelling" has been carried to the extreme in *Disceus*, to judge from its morphology, and to a lesser extent in the butterfly sting ray, *Gymnura marmorata*, which was available to me in the living condition (Fig. 1,E). In this species, the trunk and tail are so reduced that the agility with which the stinging spine was handled in *Urobatis* could not be matched and its value as a defensive weapon must be considerably reduced. As in *Urobatis*, marked release of stinging follows spinal section. Undulation of the diminutive body axis could be evoked by pinching the tail and resulted in rapid waving to and fro of that member. When swimming, the intact fish resembles, however, a tailless kite, so insignificant is the caudal appendage.

Another direction of evolution of the Batoidei has led to a re-invasion of the mid-water level. The bat stingray (*Holorhinus californicus*) is the representative of this offshoot which was available in the living state (Fig. 1,F). In it, the trunk and tail are equally reduced in importance as undulatory swimming organs. Far from being a vestigial structure, however, the tail is drawn out into a long filament and seems, upon inspection within the confines of a tank, to have important functions both as a rudder and as a sensory organ.

Discussion

The close interdependence of body form and behavior is borne out by these observations. Though it may appear obvious, I would like to reiterate the contention that in phylogeny the development of behavior patterns pro-

ceeds according to the same general laws as does the evolution of structure and, where subject to detailed scrutiny, is fully as reliable an index to relationship as is morphology. In this regard I would like to comment upon the statement in White's monograph to the effect that in elasmobranch evolution grovelling behavior preceded in time and was ancestral to the pelagic swimming. This seems not only unwarranted by the fossil record but least likely from the viewpoint of the student of behavior. Her view is based upon (1) the assumption that in early paleozoic seas, the food supply was limited to the bottom, and (2) that more archaic characters are to be found in the modern representatives of the grovelling forms. On the first line of reasoning, I shall not comment as it seems too hypothetical. The retention of archaic characters, however, does not seem to indicate an unaltered descent from bottom forms, but instead the operation of insular conservatism due to the greatly restricted ecological niches of the grovelling forms. In general, the bottom living forms have restricted ranges in contrast to the frequently world-wide distribution of the pelagic species. Even those members of the Batoidei, such as *Manta*, which have secondarily invaded the mid-water and pelagic zones are inclined to have large ranges. The presence of archaic characters may better be taken to indicate not a continuance of ancestral behavior, but a deviation from it in the direction of a more restricted ecological position. Further support for the view that the pelagic life is primary in elasmobranch evolution stems from the demonstration that the undulatory type of swimming is basic to the chordate phylum. Any view that the Selachoidei are offshoots of bottom living forms is bound to involve unparsimonious postulates concerning the loss, or near loss, of a basic pattern with its subsequent redevelopment.

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Department of Anatomy, Univ. of Minnesota, Minneapolis, Minn.

The Crested Oarfish, *Lophotus lacepedei*, from Florida; First Record for the Western North Atlantic

COLEMAN J. GOIN and DONALD S. ERDMAN

WHILE gigging fishes in shallow water at the beach near Clearwater, Pinellas County, Florida, on January 1, 1950, Mr. Nick Tsacrios, a student at the University of Florida, caught a fish which he did not recognize. Since none of the local commercial fishermen could identify it for him, he salted the specimen and brought it to the senior author two days later. It proved to be a specimen of *Lophotus lacepedei* Giorna, the first record of this genus from the western North Atlantic. It has since been catalogued as No. 151118 in the U. S. National Museum.

In going over the literature of the family Lophotidae, it appeared to us that several nominal species and genera have, in the past, been erected for what are probably individual specimens of a single species taken in various parts of the world. Therefore, at the suggestion of Dr. Leonard P. Schultz, we have prepared the following generic and specific synonymy:

GENUS *Lophotus* GIORNA

Lophotus Giorna, 1809: 179 (genotype *Lophotus lacepede* Giorna).
Leptopus Rafinesque, 1814: 16 (genotype *Leptopus peregrinus* Rafinesque).
Podoleptus Rafinesque, 1815: 93 (substitute name for *Leptopus* Rafinesque).
Lophotes Bosc, 1817: 185.
Orodinus Jordan, 1919: 339 (accredited to Gistel as a substitute for *Lophotus* by Jordan).
Regilophotes Whitley, 1933: 72 (genotype *Lophotes guntheri* Johnston).

Lophotus lacepedei Giorna

Lophotus lacepede Giorna, 1809: 180 (locality probably Mediterranean Sea).
Leptopus peregrinus Rafinesque, 1814: 16 (Palermo).
Lophotes cepedii Schinz, 1822: 400.
Lophotus cepedianus Cloquet, 1823: 194.
Lophotus lacepede Risso, 1826: 293.
Lophotus lacepedianus Bory de Saint-Vincent, 1826: 498.
Lophotes cepedianus Cuvier and Valenciennes, 1835: 405 (Mediterranean Sea).
Lophotes siculus Swainson, 1839: 397 (Monte Pelegrino, Sicily).
Lophotes capelli Temminck and Schlegel in Siebold, 1842-50: 132 (seas of Japan).
Lophotes cristatus Johnson, 1863: 38 (Madeira).
Lophotes guntheri Johnston, 1883: 176 (Emu Bay, Tasmania).
Lophotes fiskei Hutton and Drummond (not of Regan or Günther), 1904: 47 (*nomen nudum*). (*fide* Griffin, 1934: 241).
Lophotes fiski Waite (not of Regan or Günther), 1907: 33 (*nomen nudum*). (*fide* Griffin, 1934: 241).
Lophotes machadoi Miranda Ribiero, 1928: 21 (Rio de Janeiro).

Giorna published two papers on this fish; the first contained no scientific names, the second (Giorna, 1809: 179–80) was published with the intention of naming and describing the genus and species of "Le Lophote." On page 179 the genus *Lophotus* is correctly established, but on page 180 Giorna wrote "...il sera Le Lophote—Lacepede," apparently naming Le Lophote in honor

of La Cepède who spelled his name as herein given in his "Histoire Naturelle des Poissons." We see no reason why this should not be considered the definite proposal of a specific trivial name rather than the use of a mere French vernacular term. In our opinion, Giorna, in modifying the spelling of "La Cepède" to the form "Lacepede" by combining the two words and dropping the accent from the middle "e," fully showed his intent to honor his friend by using his name as a patronym for the new species. We retain the original spelling as given by Giorna, with the addition of an "i" to form the genitive, rather than the more widely used "cepedianus," in accordance with the recent recommendations of the International Commission of Zoological Nomenclature (1950, Bull. Zool. Nomen., 4: 205–09) that the definite article preceding a French surname be incorporated as part of the trivial name (as was done by Giorna himself although it has been dropped by most subsequent authors) and that the appropriate termination in the genitive case be made by adding "i" to the surname. The name of the crested oarfish is thus *Lophotus lacepedei* Giorna. If it is not accepted that Giorna actually named the species, then the first available name is *peregrinus* Rafinesque, 1814.

All nominal species of the family Lophotidae have been synonymized in this article with the exception of *Lophotus fiski* Günther, 1890 (type locality, South Africa) which is obviously a different species. Its occipital crest is prolonged anteriorly and the body is more elongate and slender. It has been placed in the genus *Eumecichthys* (Regan, 1907). No other authors have shown significant differences in describing their new species of *Lophotus*. Our review of 25 records of *Lophotus* in the literature shows a range in length from 12 to 1450 mm., and a variation in depth from 5 to 8 times in length. The dorsal rays vary from 223 to 257 (the low count of 120, given by Swainson for *L. siculus*, was taken from a painting); the anal varies from 12 to 19 rays, the pectoral from 11 to 16, and the pelvic from 5 to 6. In our specimen the first pelvic spine is very small and is closely attached to the next ray; this may explain the discrepancies in the pelvic-fin counts in the literature.

The following measurements and counts were made on the Florida specimen: standard length 835 mm.; total length approximately 845 mm. (caudal fin slightly damaged); greatest depth 145 mm.; greatest width 36 mm.; eye 37 mm.; gill rakers, 4 short upper and 7 long lower on the left side, 4 short upper and 6 long lower, plus two rudiments, on the right. Ray counts: D. I,237; A. 18; P_1 14 left, 16 right; P_2 I,5; C. 17. The first dorsal spine is enlarged but had been broken off near the base before the capture of the specimen. The dorsal rays (maximum height 41 mm.) are flexible, unbranched, and unstriated. Some of the anal rays are branched.

The premaxilla and maxilla are slightly protractile. The maxilla is large and extends forward to join its fellow of the opposite side by a fleshy lobe above the premaxilla. The teeth are arranged in three irregular rows on each jaw and are simple, conical, pointed, and somewhat depressible. Some of the anterior teeth are slightly enlarged and somewhat recurved. A small patch of teeth is present on the vomer. The nostril openings appear to be two instead of four as in most fishes. The opercles are apparently naked. The scales are very thin and fragile and evidently come off the body very readily.

Lophotus lacepedei, USNM No. 151118, Clearwater Beach, Pinellas County, Florida. Standard length, 835 mm.

A mosaic pattern present on both sides of the body and on the supra-occipital crest probably indicates the original distribution of scales. When we examined the specimen in Washington, D. C., on February 3, 1950, scales remained only on the supra-occipital crest, although when the specimen was first brought to the senior author, scattered scales were present on the sides of the body. The scales are oblong, cycloid, with irregular concentric rings. They measure about 2 mm. in greatest length. A row of larger scales is present on either side of the base of the rear portion of the dorsal fin. These scales measure about 7 mm. in diameter. The mosaic pattern of scales is illustrated in the original figure by Giorna (Pl. II, Fig. 1) and is even better shown in the figure by Cuvier and Valenciennes (Pl. CCCI).

Mr. Tsacrios informs us that when the specimen was alive the dorsal fin was a rosy pink, and the body was blue dorsally, merging to white ventrally. Published descriptions would indicate that the coloration of the present individual was typical of that of specimens taken elsewhere.

Lophotus lacepedei is apparently tropicopolitan in distribution. It has now been recorded from the Mediterranean Sea, Madeira, Cape of Good Hope, Australia, New Zealand, Tasmania, Admiralty Islands, Japan, Laysan Island, California, Rio de Janeiro, and the Gulf Coast of Florida. From its structure and rare occurrence, we judge it to be an oceanic fish which probably lives at moderate depths. Occasional individuals are washed ashore in weakened condition or are found dead on the beach. The present specimen was found swimming in quiet water about a foot in depth and was acting as if it were trying to come ashore. The specimen reported by Higgins (1920: 34) from Long Beach, California, was found under similar circumstances. No specimens, so far as we are able to determine, have been taken by fishermen using commercial fishing gear.

Kershaw (1909: 78) and Griffin (1934: 239–43) have independently reported that *Lophotus* emits an inky fluid from the vent when captured.

We are indebted to Dr. Leonard P. Schultz for suggestions and assistance in the preparation of this report.

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UNIVERSITY OF FLORIDA, GAINESVILLE, FLORIDA, AND PUNTARENAS, COSTA RICA.

New and Rare Records of Fishes from Labrador

RICHARD H. BACKUS

THE following records are based on the ichthyological collections made during the BLUE DOLPHIN Laborador Expeditions of 1949 and 1950, on which the writer served as biologist.[1] The data included represent extensions

[1] These expeditions were supported by the Arctic Institute of North America, with funds provided by the United States Government, and by funds from private sources.

of known range or are verifications of limited or doubtful past records, and are being made available to other more general works in progress, such as the notable "Fishes of the Gulf of Maine" which is now being revised.

The writer is indebted to many people, among them: Dr. Alexander Wetmore, Dr. Waldo L. Schmitt, Dr. Leonard P. Schultz and other officials of the Smithsonian Institution, for financial assistance and other help; many persons at Woods Hole Oceanographic Institution, particularly Mr. William C. Schroeder, for the loan of much fishing gear; Cmdr. David C. Nutt, master of the BLUE DOLPHIN, for his great efforts to make the collections as successful as possible; and, lastly, Dr. Edward C. Raney, of Cornell University, for his careful criticism of the manuscript and aid during its preparation.

During the summer of 1949, marine collections were made along the coast of Labrador from Forteau Bay, in the Strait of Belle Isle, to Hebron Fjord in the north. Several freshwater collections were made, the most important of which were in the vicinity of Northwest River, at the west end of Lake Melville. In the summer of 1950, marine collections were made from St. Lewis Sound north to Kangalaksiorvik. Many of these collections were in the low-salinity waters of Lake Melville. Freshwater collections were again made in the vicinity of Northwest River and additional specimens were captured near the mouth of the Hamilton River. In both years the greater part of the marine collecting was done with either beam or otter trawl. Freshwater collections were made primarily with seines and gill nets. The fishes recorded below are now in the Cornell University Fish Collection.

Raja radiata Donovan

The prickly skate, hitherto unrecorded from Labrador, was contained in six collections made in 1950 as follows:

> Domino Harbor, Island of Ponds (53° 30′ N, 55° 50′ W) on Aug. 28, by beam trawl in 10 fm. over sand bottom with some rock, 1 male, 525 mm. long (tip of snout to tip of tail) and 1 female, 410 mm. long.
>
> Lake Melville: (53° 28.8′ N, 59° 59.5′ W) on Aug. 19, by beam trawl in 15 fm. over mud bottom, 1 male, 165 mm. long; (53° 29′ N, 59° 58′ W) on July 28, by beam trawl in 9-11 fm. over mud bottom, 1 male, 120 mm. long and 1 female, 347 mm. long; (53° 31.5′ N, 60° 07.5′ W) on Aug. 19, by beam trawl in 7-11 fm. over sandy-mud bottom, 1 male, 205 mm: long; similarly on Aug. 24, 1 male, 200 mm. long; off Lowland Pt. (53° 50′ N, 59° 25′ W) on July 25, by beam trawl in 20 fm. over mixed bottom of mud, sand and rock, 1 male (imperfect), 160 mm. long (tip of snout to base of tail).

This skate has been recorded on the Atlantic coast of North America from Cape Cod to the Gulf of St. Lawrence and in Europe from the Bay of Biscay north to the White Sea and west to Spitzbergen and Greenland. Vladykov (1933) reported it from Hudson Bay. There are no Atlantic coastal records north of Lake Melville but it is probable that it is distributed along the entire coast of Labrador. We have local reports of "skates" from such northern settlements as Hopedale and Okak which are probably referrable to this species. In Newfoundland and Labrador this fish is called the "Maiden Ray."

Acipenser oxyrhynchus Mitchill

Hitherto, this fish has been known from the Gulf of Mexico to the Gulf of St. Lawrence. Prince (1898) reported it from Hudson Bay but this record is questionable and remains to be verified.

A single specimen of the Atlantic sturgeon was obtained on July 31, 1950, in Hamilton Inlet near Ticoralak Pt. (54° 15′ N, 58° 10′ W) by Dr. W. Anthony Paddon, of the International Grenfell Association, from a fisherman who had caught it in a gill net set for salmon. It measures 566 mm. in fork length, has 23 gill rakers on the first arch and has paired osseous shields before the anal fin (see Vladykov and Beaulieu, 1946).

Couesius plumbeus plumbeus (Agassiz)

In the northern part of its range, the lake northern chub is known from the Mackenzie River basin east through the eastern tributaries of Hudson Bay. To the south it is distributed throughout the Great Lakes, save Lake Erie, and in the Adirondacks, Catskills, northern New England and the northern tributaries of the Gulf of St. Lawrence. The Hamilton River basin and Grand Lake system of Labrador may now be included on the basis of the following records:

Hamilton River: outflow of Mud Lake (53° 18.5′ N, 60° 10′ W) on July 27, 1950, 1 specimen, 93 mm. in standard length; similarly on Aug. 24, 1950, 5 specimens, 44-80 mm. long; tributary of Mud Lake (53° 15′ N, 60° 10′ W) on Aug. 24, 1950, 9 specimens, 36-63 mm. long.

Northwest River (53° 31.5′ N, 60° 08.5′ W) on Aug. 23, 1949, 6 specimens, 72-118 mm. long.

Locally, the northern chub is called the "bottlefish." The same name is applied to the round whitefish, *Prosopium cylindraceum quadrilaterale*, though the latter may be qualified as the "real bottlefish."

Boreogadus saida (Lepechin)

Kendall (1909) recorded the polar cod from Chateau Bay (southern Labrador) but his record is largely discounted since the gill-raker number which he gave would refer his specimens to *Gadus callarias*. Hildebrand (1939) reported it from Ramatakvorik (northern Labrador) and Dunbar (1947) recorded the capture of two young on July 18, 1939, at Hebron (northern Labrador).

Our records, which follow, indicate that this northern species is distributed southward at least to Kaipokok Fjord.

Kaipokok Fjord: (55° 01.5′ N, 59° 33.3′ W) on July 29, 1949, by otter trawl in 45 fm. over mud bottom, 1 specimen, 95 mm. long; (55° 05′ N, 59° 30′ W) on Aug. 1, 1949, by otter trawl in 45 fm. over mud bottom, 1 specimen, 82 mm. long.

Hebron Fjord: (58° 11.4′ N, 62° 34.2′ W) on Aug. 8, 1949, by otter trawl in 95 fm. over mud bottom, 1 specimen, 75 mm. long; similarly on Aug. 9, 1949, 6 specimens, 78-91 mm. long.

Kangalaksiorvik (59° 24′ N, 63° 51′ W) on Aug. 8, 1950, by beam trawl in 50 fm. over mud bottom, some rock, 13 specimens, 68-165 mm. long.

Eumesogrammus praecisus (Kröyer)

This blenny was known only from the west coast of Greenland until Vladykov (1933) recorded it from Hudson Bay. Two years later Schmidt

and Andriashev (1935) reported it from the Okhotsk and Bering Seas although it had been known since 1904 in the Okhotsk Sea as *Ernogrammus storoshi* Schmidt. The entire coast of Labrador can now be included in its range. We have the following records:

St. Lewis Sound (52° 22.3′ N, 55° 56.7′ W) on July 12, 1949, by otter trawl in 35 fm. over mud bottom, 1 specimen, 72 mm. long.

Kangalaksiorvik (59° 23.4′ N, 62° 03.2′ W) on Aug. 10, 1950, by beam trawl in 10-12 fm. over stony bottom, some mud, 1 specimen, 40 mm. long.

Lumpenus medius Reinhardt

The known range of this snake blenny includes the waters of Greenland, Spitzbergen, Barents Sea, White Sea, Kara Sea, Bering Sea and Kamchatka. The entire coast of Labrador may now be added. This species was found at the following places:

St. Lewis Sound: (52° 21′ N, 55° 56.5′ W) on August 30, 1950, beam trawl in 35-40 fm. over mud bottom, 2 specimens, 89.5 mm. and 109.5 mm. long; (52° 22.3′ N, 55° 56.7′ W) on July 12, 1949, by otter trawl in 35 fm. over mud bottom, 1 specimen, 73.5 mm. long.

Lake Melville (53° 29′ N, 59° 58′ W) on July 28, 1950, by beam trawl in 9-11 fm. over mud bottom, 1 specimen, 102.5 mm. long.

Kangalaksiorvik: (59° 23.4′ N, 64° 03.2′ W) on Aug. 10, 1950, by beam trawl in 10-12 fm. over stony bottom, some mud, 4 specimens, 42-53.5 mm. long; (59° 24′ N, 63° 51′ W) on Aug. 8, 1950, by beam trawl in 50 fm. over mud bottom, some rock, 8 specimens, 45.5-70.5 mm. long; (59° 24′ N, 64° 01′ W) on Aug. 8, 1950, by beam trawl in 30 fm. over mud bottom, some rock, 3 specimens, 47-97 mm. long; (59° 25′ N, 63° 47′ W) on Aug. 10, 1950, by beam trawl in 50 fm. over stony bottom, 1 specimen, 79 mm. long.

Lycodes turneri atlanticus Vladykov and Tremblay

Vladykov and Tremblay (1936) concluded that *Lycodes agnostus* Jensen from the waters of the Siberian arctic and *Lycodes turneri* Bean of Alaskan waters are conspecific but they retained *agnostus* as the Siberian subspecies. In the same paper they described *L. t. atlanticus,* known from the Gulf of St. Lawrence.

Kendall (1911) recorded a specimen taken halfway between Cape Mugford and Hebron, Labrador, as *Lycodes vahlii* Reinhardt and added that no scales were evident. This report is likely referrable to *Lycodes turneri atlanticus* as the latter is the only naked eel-pout of the genus which may be expected in these waters. Labrador may now be included with certainty in the range of this subspecies on the basis of the records that follow:

Lake Melville, off Lowland Pt. (53° 50′ N, 59° 25′ W) on July 25, 1950, by beam trawl in 20 fm. over sand, mud and rock bottom, 1 specimen, 60 mm. long.

Hamilton Inlet, off Nat's Discovery Pt. (54° 14.9′ N, 58° 01′ W) on Aug. 27, 1950, by beam trawl in 45 fm. over rocky or stony bottom, 1 specimen, 65 mm. long.

Kaipokok Fjord: (54° 52.4′ N, 59° 50.3′ W) on July 29, 1949, by otter trawl in 15 fm. over mud bottom, 1 specimen, 136 mm. long; (54° 56′ N, 59° 38′ W) on July 30, 1949, by otter trawl in 55 fm. over mud bottom, 3 specimens, 132-206 mm. long; (54° 56.7′ N, 59° 43.2′ W) on July 29, 1949, by otter trawl in 45 fm. over mud bottom, 1 specimen, 63 mm. long; (55° 01.5′ N, 59° 33.3′ W) on July 29, 1949, by otter trawl in 45 fm. over mud bottom, 5 specimens, 85-123 mm. long; (55° 05′ N, 59° 30′ W) on Aug. 1, 1949, by otter trawl in 45 fm. over mud bottom, 4 specimens, 86-98 mm. long.

Hebron Fjord: (58° 08.6′ N, 62° 55.6′ W) on Aug. 11, 1949, by otter trawl in 90 fm. over mud bottom, 10 specimens, 69-159 mm: long; 58° 08.6′ N, 62° 55.6′ W) on Aug. 12, 1949, by otter trawl in 50 fm. over mud bottom, some rock, 4 specimens, 94–129 mm. long; (58° 09′ N, 62° 45.7′ W) on Aug. 9, 1949, by otter trawl in 125 fm. over mud bottom, 7 specimens, 121-177 mm. long; (58° 11.4′ N, 62° 34.2′ W) on Aug. 8, 1949, by otter trawl in 95 fm. over mud bottom, 5 specimens, 71-138 mm. long; similarly on Aug. 9, 1949, 11 specimens, 90-155 mm. long.

Kangalaksiorvik: (59° 24′ N, 64° 01′ W) on Aug. 8, 1950, by beam trawl in 30 fm. over mud bottom, some rock, 1 specimen, 59 mm. long; (59° 24′ N, 63° 51′ W) on Aug. 8, 1950, by beam trawl in 50 fm. over mud bottom, some rock, 4 specimens, 79-195 mm. long.

Cottus bairdi bairdi Girard[2]

In the northern part of its range, the northern muddler is reported from the tributaries of Hudson Bay, Lake St. John in Quebec and "reputedly from New Brunswick" (Hubbs and Lagler, 1947). The following records demonstrate its presence in the Hamilton River basin and the Grand Lake system of Labrador:

Tributary of Mud Lake, Hamilton River (53° 16′ N, 60° 11′ W) on April 24, 1950, 1 specimen, 60 mm. long.

Little Lake, Northwest River (53° 32′ N, 60° 11′ W) on Aug. 24, 1949, 5 specimens, 44-66 mm. long.

Locally, this fish is called the "gudgeon" or "freshwater sculpin."

Liparis koefoedi Parr

Through a series of misidentifications, the name *Liparis fabricii* Kröyer has long been applied to this sea-snail, particularly by the older Scandinavian writers. However, Parr (1931) has shown that *L. fabricii* is synonymous with *Liparis liparis liparis* Linnaeus. Burke (1930) and others have applied the name *Liparis major* (Gill) to *Liparis koefoedi. Liparis major* is referred by Parr (1931) to the synonymy of *Liparis liparis major* Fabricius. Thus for many years this fish was known but unnamed. Due to this confusion, little can be said with certainty regarding the range of *Liparis koefoedi.* Parr, after eliminating all uncertain records, regarded the range to include the waters of Spitzbergen, the Kara Sea, the Barents Sea and Greenland.

Dunbar (1947) recorded *Liparis fabricii* from Hebron, Labrador, on the basis of four young taken there on July 18, 1939. This record is probably referrable to *Liparis koefoedi* Parr as Dunbar compared his material with the descriptions and figures of *Liparis fabricii* in Johansen (1912). Parr (1931) referred Johansen's figures and descriptions of *L. fabricii* unhesitatingly to *L. koefoedi.*

Dannevig (1919) recorded *Liparis major* from the Gulf of St. Lawrence on the basis of three young. In ascribing them to this species, he referred the reader to Jordan and Evermann (1898). Parr (1931) indicated that the description of *L. major* found in Jordan and Evermann is applicable to *Liparis liparis major* Fabricius and not to *Liparis koefoedi. Liparis liparis major* is known with certainty only from the west coast of Greenland. Dannevig's record, on the basis of small and poorly preserved material, is open to question.

[2] Not to be written *C. bairdii*, as was done originally, according to recent changes in the International Rules of Zoological Nomenclature (1950, Bull. Zool. Nomen., 4:200-06). Opinion 8 has been cancelled.

The following material of *Liparis koefoedi* was taken in Labrador:

Goose Bay, Lake Melville (53° 24′ N, 60° 04′ W) on July 6, 1950, by otter trawl in 30 fm. over mud bottom, 2 specimens, 45 and 68 mm.

Hebron Fjord: (58° 09′ N, 62° 45.7′ W) on Aug. 9, 1949, by otter trawl in 125 fm. over mud bottom, 15 specimens, 68-178 mm. long; (58° 11.4′ N, 62° 34.2′ W) on Aug. 8, 1949, by otter trawl in 95 fm., over mud bottom, 2 specimens, 59 and 150 mm. long; similarly on Aug. 9, 1949, 2 specimens, 58 and 65 mm. long.

Kangalaksiorvik (59° 24′ N, 63° 51′ W) on Aug. 8, 1950, by beam trawl in 50 fm. over mud bottom, some rock, 2 specimens, 47 and 116 mm. long.

Triglops nybelini Jensen

This sculpin was confounded with *Triglops pingeli* Reinhardt for many years. Jensen (1944) gave the range as the waters of East and West Greenland and Jan Mayen. Labrador may now be included on the basis of:

A specimen, 50 mm. in length, taken in Hebron Fjord (58° 09′ N, 62° 45.7′ W) on Aug. 9, 1949, at a depth of 125 fm., by otter trawl over mud bottom.

Hippoglossus hippoglossus Linnaeus

The northern limit of the halibut in the western Atlantic has been considered to be the Strait of Belle Isle. We have a record for northern Labrador.

One specimen, 522 mm. long, was secured in Cut-throat Harbor (57° 55′ N, 62° 10′ W) on Aug. 5, 1950. It was found dead in the water adjacent to a cod stage operated by a band of Eskimos and had probably been taken in a cod trap not far away, brought in and discarded.

Hippoglossoides platessoides Fabricius

The plaice has not been definitely recorded north of the Strait of Belle Isle in North America. Our records show it to be generally distributed north to, and including, Hamilton Inlet and Lake Melville. It was taken at the following localities:

St. Lewis Sound: (52° 20′ N, 55° 51′ W) on Aug. 30, 1950, by beam trawl in 20-35 fm. over mud bottom, 3 specimens, 115-133 mm. long; (52° 21′ N, 55° 56.5′ W) on Aug. 30, 1950, by beam trawl in 35-40 fm. over mud bottom, 2 specimens, 117 and 158 mm. long; (52° 22.3′ N, 55° 56.7′ W) on July 12, 1949, by otter trawl in 35 fm. over mud bottom, 6 specimens, 64-116 mm. long.

Domino Harbor, Island of Ponds (53° 30′ N, 55° 50′ W) on Aug. 28, 1950, by beam trawl in 10 fm. over sand bottom, some rock, 3 specimens, 36-196 mm. long.

Off South Strand near Pigeon I. (53° 54′ N, 57° 04′ W) on Aug. 27, 1950, by beam trawl in 13 fm. over sand bottom, 4 specimens, 74-305 mm. long.

Lake Melville: (53° 28.8′ N, 59° 59.5′ W) on Aug. 19, 1950, by beam trawl in 15 fm. over mud bottom, 2 specimens, 140 and 142 mm. long; (53° 29′ N, 59° 58′ W) on July 28, 1950, by beam trawl in 9-11 fm. over mud bottom, 2 specimens, both 75 mm. long; (53° 32.2′ N, 60° 03′ W) on July 8, 1950, by beam trawl in 55 fm. over mud bottom, 1 specimen, 160 mm. long; (53° 52′ N, 59° 19′ W) on July 11, 1950, by beam trawl in 30–35 fm. over mud bottom, 1 specimen, 202 mm. long; (53° 50′ N, 59° 25′ W) on July 25, 1950, by beam trawl in 20 fm. over sand, mud and rock bottom, 1 specimen, 175 mm. long; (53° 56′ N, 59° 03′ W) on July 12, 1950, by beam trawl in 45 fm. over mud bottom, 1 specimen, 172 mm. long.

Hamilton Inlet: (54° 15′ N, 57° 45′ W) on Aug. 27, 1950, by beam trawl in 30 fm. over mud and stone bottom, 7 specimens, 35-125 mm. long; Ice Tickle (54° 30′ N, 57° 15′ W) on July 16, 1950, by long-line in 30 fm., 1 specimen, 360 mm. long.

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Department of Conservation, Cornell University, Ithaca, New York.

Ichthyological Notes

THREE EARLY HISTORICAL REPORTS OF NORTH AMERICAN FRESHWATER FISHES.—In a recent study of freshwater fish and fishing in aboriginal North America I found a few early reports of fishes that may be of interest to ichthyologists because the reports come from regions well beyond the known ranges of the species as determined from literature records, thus suggesting that natural changes in the distribution of these fishes may have taken place during relatively recent time.

Paddlefish, *Polyodon spathula* Walbaum

It has generally been thought that the oldest reference to *Polyodon spathula* is Marquette's account of a specimen seen in the Mississippi River in the year 1673 (Jesuit Relations, 59: 111). But a dozen or more years earlier, Radisson observed what must have been a paddlefish in the region of the "Lake of the Stinkings." In his quaint English, Radisson described the fish as follows, "Heere we saw fishes of divers, some like the sturgeons and have a kind of slice att the end of their nose some 3 fingers broad in the end and 2 oneley neere their nose, and some 8 thumbs long, all marbled and of a blakish collor" (*in* Early Narratives of the Northwest 1634-1699, ed. by L. P. Kellogg, New York, 1917: 49).

When Radisson saw this fish (on his third journey, which took place either 1658-1660 or 1654-1656), he was most likely in the vicinity of Lake Winnebago or Green Bay, Wisconsin, because the Winnebago Indians are known in the old sources as Stinks, Stinkards, or Puants; the fish was therefore in waters tributary to the Great Lakes. This conclusion is strengthened by the fact that Radisson did not reach the tributaries of the Mississippi River until the time of his fourth journey. The fish could hardly have been a gar pike, for by 1660 the French had long known that fish and had a name for it, "poisson armé," a term surely known to Radisson; anyway, the description seems best to fit the paddlefish.

It has been believed by some that the paddlefish reached the Great Lakes through canals in recent time; another opinion is that the species was native there but on its way to natural extinction in northern waters (Hubbs and Lagler, 1947, Cranbrook Inst. Sci. Bull. 26: 29). If Radisson's fish was a paddlefish, it confirms the latter opinion, for there were no canals in the year 1660.

Buffalofish, *Ictiobus* species

There seems to be no record in the ichthyological literature of buffalofish in the region northeast of the western end of Lake Erie and southern Lake Michigan, where, in the opinion of Hubbs and Lagler (1947: 50), some of the species are probably native. As pointed out by Hubbs (1930, Pap. Mich. Acad. Sci. Arts, Lett., 11 (1929): 427), Kirtland's specimen at Rockport, Ohio, shows that *I. cyprinellus* has at least sporadically occurred in Lake Erie for many years. Since the Ohio and Erie canal was opened in 1832, and the Miami and the Wabash canals in 1843, it is possible that even Kirtland's specimen might have been a canal immigrant, thus apparently raising the question whether the buffalofish was actually native in Lake Erie. There is, however, a record of an even earlier buffalofish to consider.

It is reported that among the remains of 7 different species of fishes found in the Roebuck prehistoric village site in Grenville County, Ontario, some 400 miles northeast of the western end of Lake Erie, the bones of buffalofish have been identified (Wintemberg, 1936, Nat. Mus. Canada, Bull. 83, Anthrop. Ser., 19: 15). The age of the site is unknown, but in the view of Wintemberg it was probably occupied and abandoned by the Indians before the arrival of the first European explorers. The identification probably needs to be checked; if verified, this record shows that a buffalofish was not only native in the region but also that its distribution was once much wider in the northeast than is now indicated.

DOLLY VARDEN, *Salvelinus malma* (Walbaum)?

No mention is made of dolly varden or of any other charr in the ichthyological reports from the Bonneville drainage system. The region nearest to the Bonneville system from which the dolly varden is recorded is Lost River, Idaho, where Hubbs and Miller (1948, Bull. Univ. Utah, 10 (7): 76) found an isolated colony, regarded by them as a glacial relict. The following early report may or may not refer to *Salvelinus,* but it seems important enough to note.

In 1834 John K. Townsend encamped with the expedition of Wyeth on the Bear River, tributary to the Great Salt Lake, and observed that "trout, grayling, and a kind of char are very abundant here" (*in* Early Western Travel, ed. by R. G. Thwaites, 21: 199). As Hubbs suggested in a letter (1950), the "grayling" may well have been the mountain whitefish (*Prosopium*), which is still occasionally called by that name in some regions, but the reference to the charr might be more significant. Townsend was a physician and naturalist, the main reason for his being on the expedition, and therefore a person who might be expected to know something about fishes; and since he was from Pennsylvania it seems reasonable to think that he was familiar with the eastern brook trout and would know a charr when he saw one. It is perhaps not at all impossible that Townsend actually saw the dolly varden in a Bonneville stream.—ERHARD ROSTLUND, *Department of Geography, University of California, Berkeley 4, California.*

IDENTIFICATION AS OSMERIDS OF TWO FISHES DESCRIBED FROM THE NORTH PACIFIC AS PARALEPIDIDS.[1]—For some time we have both suspected that *Sudis squamosa* Chapman (1939, Proc. U. S. Nat. Mus., 86: 519–22, fig. 63) and *Lestidium* (*Bathysudis*) *parri* Chapman (*ibid.*: 522–24, fig. 64), both described from specimens caught in plankton hauls off Alaska, might not belong to the "Sudidae" (Paralepididae); and now Robert R. Harry, in his revision of the Paralepididae, has come definitely to the conclusion that neither nominal species should be included in the family to which it was assigned. To clarify the identification of these two species we examine the holotypes at the U. S. National Museum.

The holotype and only known specimen of *Sudis squamosa* (USNM No. 108150), from off the southern shore of the Alaskan Peninsula, proves without question to be a half-grown Pacific capelin, *Mallotus catervarius* (Steller, in Pennant, 1784, Arctic Zoology, 1: cxxvii). Comparison of specimens discloses no differences. Obviously, at least some capelin retain a pelagic habitat until they are half-grown. As Schultz (1937, Proc. U. S. Nat. Mus., 85: 13–20) has shown, *catervarius* is the oldest name for the Pacific form of *Mallotus*. We do not concur in a recent rejection of this name in favor of *M. villosus socialis* (Pallas), on the basis of the statement that Pennant, 1784, was "non binominal" (Berg, 1948, Ribi Presnich Bod SSSR i Sopredelnich Stran ["Fresh-water fishes of the U. S. S. R. and neighboring countries"], Akad. Nauk, 4th ed., 1: 452). After examining the original treatise we believe that the name *catervarius* can be retained, even though Pennant did not consistently employ binominal nomenclature. Steller, though pre-Linnaean, was binominal, and his names, including *"Salmo Catervarius* of STELLER," would appear to have acquired availability when published by a post-Linnaean author, in this case Pennant. Pennant indicated that Pallas supplied the fish accounts from the manuscript of Steller. Pallas was also a binominal author.

The holotype of *Lestidium* (*Bathysudis*) *parri* (USNM No. 108140), from off Prince William Sound, Alaska, is just as surely identifiable as an eulachon, *Thaleichthys pacificus* (Richardson). It is a young specimen in the pelagic "Eperlanio" stage (Hubbs, 1925, Proc. Biol. Soc. Washington, 38: 53).

The agreement between these holotypes and comparable specimens of *Mallotus* and *Thaleichthys,* respectively, extends to details of dentition, to superficially apparent features of anatomy, and to other characters indicated in our respective treatments of the systematics and the osteology of the osmerids (Hubbs, *op. cit.*; Chapman, 1941, Jour. Morph., 69: 279–301, figs. 1–15). The items of precise correspondence include details of pigmentation.—CARL L. HUBBS, *Scripps Institution of Oceanography (University of California), La Jolla, California,* and WILBERT M. CHAPMAN, *American Tunaboat Association, San Diego, California.*

[1] Contributions from the Scripps Institution of Oceanography, New Series, No. 526.

MINIMUM TEMPERATURE TOLERANCES FOR FISHES OF THE GENERA *SIGNALOSA* AND *HERICHTHYS* IN TEXAS.—From January 30 to February 2, 1951, a cold wave swept over central Texas. This cold spell, although not the coldest on record, included the longest interval of below-freezing weather recorded for Austin. The prolonged chilling weather probably caused a greater reduction of the water temperature than past colder but shorter periods. Shortly after this spell, the ichthyology class at the University of Texas made several collections in and around the Colorado River at Austin. The pertinent collections were: (1) The Colorado River above the mouth of Shoal Creek, water temperature 12.2° C.; (2) The mouth of Shoal Creek, 19° C.; and (3) The Colorado River three miles downstream from the mouth of Shoal Creek, 14.2° C.

Many recently dead *Signalosa petenensis atchafalayae* Evermann and Kendall were collected at Station 1. One specimen, nearly frozen, was still living, and after being warmed by hand for approximately one minute, it began to move. Another threadfin shad, taken at Station 3, was not very active, but was definitely not aestivating. From the above data, it is assumed that the minimum temperature tolerance for *S. p. atchafalayae* in the Colorado River is between 12.2° and 14.2° C.

Several recently dead *Herichthys cyanoguttatus cyanoguttatus* Baird and Girard were observed at Stations 1 and 3. No living specimens were taken at these localities, although a flourishing population was found at Station 2. It is assumed that the minimum temperature tolerance for *H. c. cyanoguttatus* at this locality is between 14.2° and 19° C, probably closer to 14.2° C.—CLARK HUBBS, *Department of Zoology, University of Texas, Austin, Texas.*

NOTES ON GULF OF MAINE FISHES IN 1949.—The waters of the Gulf of Maine during June to October, 1949, were unusually warm. This is evident from the records of the U. S. Coast and Geodetic Survey. This agency has been recording the surface sea water temperatures at Boston, Massachusetts, since 1922; at Portland, Maine, from 1922 to 1945 and for 1949; and at Eastport, Maine, since 1930. The mean monthly temperature at each of these stations from June to October, 1949, was higher, with one exception, than the average monthly mean for the entire period of observation. The exception was for September at Boston when the water temperature was 0.4 degrees Fahrenheit below the 1922–1949 September mean. The 1949 Boston water averaged 2.8 degrees above the 28 year means for the five months; Portland, 3.8 degrees; and Eastport, 2.5 degrees. The 1949 monthly means in Portland were the highest recorded there, while Eastport and Boston each had record high temperatures in three of the five months. In general, the water temperatures have been above average during the past few years, but 1949 has been the peak since 1922 (see Arnold, 1951, COPEIA (1): 87–88). Further data on the Northwest Atlantic surface water increase are presented by Hachey and McLellan (1948, Jour. Fish. Res. Bd. Canada, 7(6): 355–362).

It is difficult to evaluate the influence of this warmer water on the fauna along the Maine coast. Past records of the occurrence of unusual fish are scanty, primarily because there have been few observers in the area. Except for observations during field trips and personal inquiries among fishermen, we have not been able to make any intensive effort to collect information regarding any change in the fish fauna in 1949. In the Gulf of Maine we have obtained the following 1949 records of fish which usually prefer the warmer waters south of Cape Cod (all measurements, except where noted otherwise, refer to total length).

Prionace glauca (Linnaeus); great blue shark.—A 214-cm. female was landed by a line trawl fisherman at Portland, Maine, on September 13. Its weight, with viscera removed, was 58 pounds. A 336-cm. male weighing 297½ pounds, caught in a fish trap at Barnstable, Massachusetts, on September 14, was examined. The liver weighed 27 pounds. The drawn market weight (viscera, head, pectoral and caudal fins removed) was 135 pounds. The stomach contained four partially digested squid (*Loligo pealei*). The Portland shark was processed in a fish meal plant, while the Barnstable specimen was shipped to the Boston market for fresh consumption. Reports from fishermen indicate that the "blue dogs," as this shark is commonly called, were more abundant than usual in the inshore waters of the Maine coast during 1949.

Carcharodon carcharias (Linnaeus): great white shark.—A Deer Island, New Brunswick, fisherman shot a 387-cm. immature female weighing 1,299 pounds in a herring weir on August 24. The liver weighed 180 pounds; the empty stomach, 37; the spiral valve, 12; and the head, 312. Proportional measurements in percent of total length were: tip of snout to anterior insertion of first dorsal, 38.2; tip of snout to anterior insertion of pectoral, 25.0; anterior insertion of first dorsal to anterior insertion of second dorsal, 32.9; and height of first dorsal, 10.5. This shark, called a "cow shark" by the local fishermen, was sent to a fish meal plant. It is probable that some of the large sharks caught occasionally in these waters may be of this species.

Brevoortia tyrannus Latrobe; menhaden.—A great catch of menhaden during the past three years has been made by purse seiners in Cape Cod Bay. No records are available for the Cape Cod Bay fishery because this production is credited to the fishery statistics for New York State to which the fish are taken for reduction. The large menhaden seiners usually operate in the waters around the east end of Long Island, New York, but when the menhaden are scarce there they search for fish in more distant areas. An increase in the purse seine menhaden catch from southern Massachusetts waters indicates, therefore, that not only were there quantities of fish in that section, but also that the fish were not abundant in Long Island waters. Perhaps conditions were less favorable for this species in Long Island Sound or adjacent areas and many of the schools may have migrated to Cape Cod Bay and farther north. The greatest seining activity in the Gulf of Maine was observed between Provincetown and the Cape Cod Canal. We estimate that the total catch in that area was several times greater than the combined catches around Gloucester, Massachusetts, and off Western Maine.

A large menhaden boat and several boats that usually catch mackerel operated from August to September in the vicinity of Gloucester Harbor and caught about eight million pounds of menhaden. The catch undoubtedly would have been larger if the menhaden seining had begun earlier in the season.

During 1949, over 5,000,000 pounds of menhaden were caught on the Maine coast between June and September by a large menhaden purse seiner and a few small boats which normally caught herring. In 1948, a total of over 145,000 pounds were taken, and in 1947, only about 14,000 pounds. In 1948, there was no organized Maine menhaden fishery as in 1949; therefore, it is difficult to compare the two years. We believe, however, that these fish were more abundant in Maine in 1949 than in 1948. The recent increase in the occurrence of this species in Maine has been previously noted by Scattergood (1948, COPEIA (2): 142–144).

Pneumatophorus colias Gmelin; chub mackerel.—A 321-mm. fish was caught in a Johns Bay, Maine, floating fish trap in August.

Seriola zonata (Mitchill); banded rudderfish.—This species was reported at various points along the Gulf of Maine. We heard of several in Maine at Boothbay Harbor and the Sheepscot River, and in Massachusetts at Gloucester.

Prionotus carolinus (Linnaeus); common sea robin.—A 332-mm. fish was caught in a herring weir at Campobello Island, New Brunswick, on August 23.

Balistes carolinensis Gmelin; common triggerfish.—A 309-mm. fish was caught by a sportsfisherman in Linekin Bay, Maine, on August 7. Clifford Pye of Small Point, Maine, reported another specimen taken in the fish trap which he operated in the summer months.

Chilomycterus schoepfii Walbaum; burrfish.—A 159-mm. specimen was caught in a West Point, Maine, fish trap on August 5. A related form, the common puffer (*Sphoeroides maculatus*), is not an unusual fish in Western Maine waters, but this is the first record of a burrfish in Maine waters, to our knowledge.

Mola mola (*Linnaeus*); ocean sunfish.—One of these fish was harpooned near Birch Harbor, Maine, on July 23. The event was recorded in the August issue of the Maine Coast Fisherman. Photographs of the fish indicate that it was 1.5 meters long.

More unusual than any of the above fish records were the captures during the summer of blue crabs (*Callinectes sapidus*) in Maine waters. A lobster fisherman at Small Point, Maine, caught one. Another specimen caught in the Damariscotta River was brought into the Boothbay Harbor fisheries station.—LESLIE W. SCATTERGOOD and PARKER S. TREFETHEN, *U. S. Fish and Wildlife Service* and GARETH W. COFFIN, *Maine Sardine Packers Association, Boothbay Harbor, Maine.*

CATOSTOMUS ARENARIUS, A GREAT BASIN FISH, SYNONYMIZED WITH *C. TAHOENSIS*.[1]—Our explorations of the freshwater fish faunas of Western North America have indicated that several species now recognized as distinct are invalid. In this note *Catostomus arenarius* Snyder, a nominal species of the Lahontan system, in Nevada and California, is indicated as a synonym of *C. tahoensis* Gill and Jordan.

Catostomus tahoensis Gill and Jordan

In his outstanding treatise on the fishes of the Lahontan system, Snyder (1917, Bull. U. S. Bur. Fish., 35: 47–49) described *Catostomus arenarius* as a new species, on the basis of eight specimens from six localities in the drainage basin of ancient Lake Lahontan. He distinguished *C. arenarius* from *C. tahoensis* by scale number only, giving the range of variation for the lateral-line scales as 68 to 75 for *arenarius* (68 in 1 specimen, 73 to 75 in 7) and as 81 to 96 for *tahoensis*. The paratype that yielded the very low count of 68 has not been relocated. We have failed to confirm such a distinction of a coarse-scaled and a fine-scaled form, for we have recorded a continuous and normal variation of 73 to 100 in specimens from various parts of the Lahontan system, including the available types of *C. arenarius*. The holotype, USNM No. 75654, has 74 or 75; four paratypes, USNM Nos. 21093 and 75679-81, kindly counted for us by E. A. Lachner, have 74 (2) to 75 (2); a fifth specimen 399 mm. in standard length (USNM No. 75245), presumably a paratype (see column 4 of table in Snyder, 1917: 49), has 73 (75 on right side); another paratype, at Stanford University (No. 23949), has about 78. In a series of nearly topotypic specimens in the University of Michigan Museum of Zoology (No. 133840), from the mouth of Truckee River, Nevada, the counts range from 83 to 98. The scale counts on both sides of four topotypes at the University of California, from the east shore of Pyramid Lake near the Pyramid, varied from 86 to 100 (counts kindly made for us by Warren Freihofer, through the courtesy of Paul R. Needham). In 16 specimens from Carson River, 2 miles west of Fallon, Nevada (UMMZ No. 124855), the variation is from 78 to 97.

That two forms are not represented is further indicated by the fact that the coarse-scaled individuals are otherwise indistinguishable from other specimens in the same collections. These individuals certainly appear to be extreme variants of *C. tahoensis*. Their selection by Snyder from the large series available to him and their designation as a distinct species appear attributable to his stated belief and indicated conviction that each major drainage of western United States has a pair of species of *Catostomus*, respectively representing a coarse-scaled and a fine-scaled series. He (Snyder, 1917: 42, footnote *b*) further expressed the view that the *Catostomus* pairs alternate in abundance in the several drainages. Thus in the Lahontan and Klamath systems, the coarse-scaled types (*arenarius* and *snyderi*) he held to be rare, the fine-scaled forms (*tahoensis* and *rimiculus*) abundant, whereas in the Sacramento system the small-scaled *C. microps* is rare and the large-scaled *C. occidentalis* is widespread. *C. snyderi* is now known to be common.

Rather than comprising just two series of cognate species, the several species of *Catostomus* of Western North America are largely allopatric, and they are readily distinguishable on characters other than scale size. In the Sacramento drainage of California and southern Oregon, *C. occidentalis* is the widespread form, *C. microps* a local isolate of Rush Creek evidently not closely related to *occidentalis*. In the Klamath system of Oregon, *C. snyderi* occurs commonly only above Klamath Falls, whereas *C. rimiculus*[2] lives below these falls as well as in Rogue River. In the Columbia River drainage, *C. macrocheilus* and *C. columbianus* (formerly *C. syncheilus*) inhabit the same streams, but have contrasting ecological requirements (Miller and Miller, 1948, Copeia (3): 177–80). In the Colorado River system, *C. insignis* is almost wholly confined to the Gila River basin, whereas the very different *C. latipinnis* is (or was) widespread, and is sharply segregated ecologically from *insignis* where the two occur in the same waters.

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[1] Contributions from the Scripps Institution of Oceanography, New Series, No. 518.

[2] *Catostomus oregonus* Gilbert (1898, Bull. U. S. Fish Comm., 17 (1897): 2) has page priority over *C. rimiculus*, but is a *nomen nudum*. It was obviously based on the same material and was presumably a manuscript name that was elsewhere changed in the original description to *rimiculus*.

In the eastern tributaries of the Gulf of California, *C. sonorensis* Meek is widely distributed, but *C. bernardini* Girard and *C. wigginsi* Herre and Brock evidently are of very local distribution.

The Lahontan system is not the only major drainage of the West that has but a single representative of *Catostomus,* for the Owens River basin of the Death Valley system also contains only one member of this genus. This distinct species (yet to be described) was referred by Snyder (1917, Proc. U. S. Nat. Mus., 54: 202) to *C. arenarius,* since it has about the same scale counts as were attributed to that nominal species. In contrast to the great scarcity of specimens corresponding with "*C. arenarius*" in the Lahontan system, the Owens sucker is common and widespread.

The evidence is compelling that *Catostomus arenarius* was based on large-scaled variants of *C. tahoensis:* (1) specimens agreeing with the description of *arenarius* are rare and sporadic in distribution and nowhere comprise a population; (2) the large-scaled variants in the Lahontan system are otherwise indistinguishable from finer-scaled specimens captured simultaneously; (3) the similarly coarse-scaled suckers that do form populations in the Owens River system are specifically separable on the basis of other characters; (4) the reported difference in scale counts is not as great as Snyder indicated and the low scale counts comprise one end of a frequency curve of normal distribution and of not surprisingly wide range; and (5) the two species of *Catostomus* in other drainages are readily separable on more basic features than scale size, a meristic character subject to much individual and geographic variation.—CARL L. HUBBS, *Scripps Institution of Oceanography (University of California), La Jolla, California,* and ROBERT RUSH MILLER, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

THE FALLFISH, *SEMOTILUS CORPORALIS,* FROM THE LAKE SUPERIOR DRAINAGE OF WESTERN ONTARIO.—On August 22, 1943, while fishing for eastern brook trout, *Salvelinus fontinalis* (Mitchill), in the lower stretches of Cedar Creek, Thunder Bay District, Ontario, I caught a cyprinid which has been identified as the fallfish, *Semotilus corporalis* (Mitchill), by Dr. W. B. Scott, Curator of the Division of Ichthyology and Herpetology, Royal Ontario Museum of Zoology, Toronto. The specimen is in the collection of that Institution. Cedar Creek is a typical brook trout stream, its cold, clear waters flowing into the Whitefish River a few miles above its junction with the Kaministiquia River. Fifteen miles downstream the Kaministiquia flows into Lake Superior at Fort William.

The fallfish occurs in eastern Ontario throughout the drainage of the Ottawa and St. Lawrence rivers. It also frequents the rivers flowing into James Bay. In 1914 it was reported from the Moose River by Melville (App. Ann. Rept. Dept. Naval Serv., 27: 5–28), and there is a specimen in the Royal Ontario Museum of Zoology from the Fire River, a branch of the Missinaibi, which like the Moose flows into James Bay (Dymond, 1947, Roy. Ontario Mus. Zool., Misc. Publ., 1: 19). Although the fishes of this part of Ontario have received little attention, the streams flowing into Lake Superior along the north shore of Minnesota have been intensively studied in recent years. The absence of this species from those collections suggests that it is an addition to the fish fauna of the Lake Superior drainage. A probable explanation of its recent entrance is available. In 1938, the waters of the Kenogami River were diverted into the headwaters of the Aguasabon River, which enters Lake Superior 135 miles northeast of Fort William. In July, 1943, Ogoki River waters were similarly diverted into Lake Nipigon, to eventually enter Lake Superior via the Nipigon River, 70 miles northeast of Fort William. Both the Kenogami and the Ogoki are tributaries of the Albany River, which flows eventually into James Bay. It is my belief that the fallfish entered the Lake Superior drainage by means of one, or possibly both, of these diversions. A time element would suggest the Kenogami-Aguasabon channel as the source of the Cedar Creek specimen.—A. E. ALLIN, *Regional Laboratory, Ontario Department of Health, Fort William, Ontario, Canada.*

FIRST RECORD OF THE GEMPYLID FISH *EPINNULA ORIENTALIS* FROM AMERICAN WATERS.—In a small collection of fishes taken incidentally by Mr. Stewart Springer during the work of the Exploratory Fishing and Gear Development Section of the Commercial Fisheries Branch, U. S. Fish and Wildlife Service, at Pascagoula, Mississippi, and sent to this museum for identification, was a specimen clearly referable to *Epinnula orientalis* Gilchrist and von Bonde (1924, Fish. and Mar. Biol. Surv. Rep. 3 (1922), Spec. Rep. VII: 15, pl. 4, fig. 1). The specimen, 165 mm. in standard length (Stanford No. 16789), is believed to be the first New World record of the species.

The fish was taken by the Fish and Wildlife Service Research Vessel OREGON on August 2, 1950, at 29° 09′ N. lat., 88° 33′ W. long. (Station No. 60, in the Gulf of Mexico off the Mississippi coast) with a 40 foot shrimp trawl at a depth of 110 fathoms. It is easily distinguishable from *Epinnula magistralis* Poey (1854, Mem. Hist. Nat. Cuba, 1: 369, 371), the only other known species of the genus, in possessing more dorsal and anal fin rays, in the more posterior ventral fin placement, and in the location of the point of bifurcation of the lateral lines. *E. magistralis* is known from the Caribbean (Goode and Bean, 1895, Oceanic Ichthyology: 198) and from off Japan (Kamohara, 1938, Annot. Zool. Jap., 17 (1): 48). Exclusive of the specimen now at hand, *E. orientalis* is known only from depths of 150-300 fathoms in waters off Natal and Delagoa Bay in the Indian Ocean off South Africa (Smith, 1950, Sea Fishes of South Africa: 311) and from seven Japanese specimens (Kamohara, *op. cit.*).—GILES W. MEAD, *Natural History Museum, Stanford University, California.*

OCCURRENCE AND HABITAT OF THE DARTER *HOLOLEPIS FUSIFORMIS EROCHROUS* IN MARYLAND.—The blackwater darter, *Hololepis fusiformis atraquae,* was described by Hubbs and Cannon (1935, Misc. Publ. Mus. Zool., Univ. Mich., 30: 68–72) on the basis of a single collection from Mattawoman Creek. It was regarded by these authors as endemic to the "lower Potomac River drainage of Maryland or to the immediate vicinity." On page 67 of the same paper, they defined *Hololepis fusiformis erochrous* Cope as ". . . a very poor unit, as it exhibits marked local differences. Some of these may prove subspecifically separable." Their material of this subspecies came from Delaware, Pennsylvania, and New Jersey, from the northeastern part of the Chesapeake Bay drainage to the Raritan River drainage. Although Hubbs (1933, COPEIA, (2): 106) originally recorded *H. fusiformis,* later described as *H. f. atraquae,* from Maryland, Hubbs and Cannon (*op. cit.*) overlooked the reference by Lugger (1878, Rept. Comm. Fish. Md., 1878: 114) to the "mud-loving darter, *Boleichthys erochrous,*" from the dark, sluggish creeks of Worcester County, Maryland. Truitt, Bean and Fowler (1929, Conserv. Comm. Md., Bull. 1) and Fowler (1945, Acad. Nat. Sci. Phila., Monogr. 7) did not record *Hololepis* from Maryland.

The following records definitely establish the occurrence of *H. f. erochrous* in the Chesapeake Bay drainage system of Maryland. During 1949 and 1950, specimens were collected in the Coastal Plain of the eastern shore of Maryland, adjacent to Delaware, at these localities: (1) Somerset County, Princess Anne, in sluggish, slightly-acid stream, June 13, 1949, 1 juvenile; (2) Wicomico County, in Tonytank Pond, one mile south of Salisbury, June 13, 1949, 3 adults; also August 17, 1950, 11 specimens ranging from 28 to 37 mm. in total length; (3) Caroline County, Smithville Pond, Smithville, in muddy millpond with abundant aquatic vegetation, July 28, 1949, 2 adults; also August 16, 1950, 42 specimens (27 to 39 mm); (4) Caroline County, Harmony Pond, near Preston, July 28, 1949, 1 adult; (5) Caroline County, Garland Lake, August 15, 1950, 10 specimens (26 to 39 mm).

An index of the abundance of *Hololepis* in the millponds of the eastern shore of Maryland was obtained from the use of emulsifiable rotenone at Chambers Lake, Federalsburg, Caroline County, on October 26, 1950. Four or five minutes after the application of the drug, darters ceased activity and remained motionless underwater. An examination of about one-tenth of the six-acre pond revealed perhaps 1,000 dead specimens on the edges of the pond after the drawdown, while many more probably escaped notice on the bottom and in inaccessible sections of the pond.

The ponds of this part of Maryland are ecologically distinct from those of the western shore. Most of the area in which *Hololepis* has been found is low and flat, and is drained by numerous small creeks. All of the ponds were originally constructed as

artificial millponds to produce power to grind grain and saw lumber at milldams. In recent years the dams have not been used; consequently, many have washed out after heavy rains. The ponds are usually characterized by the presence of *Sparganium, Nymphaea advena,* and *Pontederia cordata,* rooted to a muddy and sometimes sandy bottom. Fish collections from them were made during the critical, warm summer period, and chemical and physical results are given in Table I. Temperature fluctuations at

TABLE I

CHEMICAL AND PHYSICAL CHARACTERISTICS OF MILLPONDS CONTAINING *Hololepis fusiformis erochrous*[1]

Locality	Date	Depth in feet	Temp., °F	Dissolved O_2, ppm	CO_2, ppm	PH-TH[2], ppm	Methyl orange, ppm	Total alkalinity, ppm	pH	Salinity, ppt	Secchi disk in feet
Tonytank	7/26/49	0	83	—	15	0	25	25	7.4	2.0	4.7
Pond	8/17/50	9	72	3.4	44	0	29	29	6.8	—	4.0
	7/28/49	0	90	5.3	0	1	19	20	8.1	—	2.0
Garland		8	79	6.2	3	0	—	—	7.5	—	—
Lake	8/15/50	0	79	11.1	5	0	26	26	8.0	—	—
		5	75	3.2	10	0	27	27	6.8	—	—
Smith	7/28/49	0	90	6.3	4	0	15	15	7.1	—	2.8
Pond	8/16/50	0	76	6.7	8	0	11	11	7.0	—	3.2
		5	75	4.9	10	0	13	13	6.8	—	—
Chambers	8/16/50	0	74	8.9	10	0	10	10	7.0	—	4.5
Lake		6	72	9.7	12	0	10	10	6.8	—	—

[1] Results supplied by R. D. Van Deusen.
[2] Phenolphthalein alkalinity.

various depths were normal. The dissolved oxygen concentration at the surface seemed slightly lower when compared to that found in ponds on the western shore of Maryland. In about half of the ponds tested, the dissolved oxygen was somewhat less at the bottom than at the surface. This was supported by low free carbon dioxide readings. Phenolphthalein titration indicated the almost complete absence of hydroxide or normal carbonate alkalinity, while the methyl orange titration showed the presence of bicarbonates. Hence, the soft-water ponds have probably promoted the development of abundant chlorophyllaceous plants. The pH varied from 6.8 to 8.1, usually close to neutral, even though the stained, tea-colored waters appeared to be acidified from vegetable acids. The millpond waters were almost free of salts, although flood-tides from Chesapeake Bay often reached the gates of the milldams.

The following species of fishes were found in close association with *Hololepis*: *Eudontomyzon aepypterus, Erimyzon o. oblongus, Notemigonus c. crysoleucas, Ameiurus n. nebulosus, A. natalis, Schilbeodes mollis, Esox niger, E. americanus, Anguilla rostrata, Aphredoderus s. sayanus, Perca flavescens, Boleosoma nigrum olmstedi, Micropterus s. salmoides, Lepomis auritus, L. m. macrochirus, L. gibbosus, Acantharchus pomotis, Mesogonistius c. chaetodon, Enneacanthus obesus, E. gloriosus, Pomoxis nigromaculatus.* The largemouth bass, bluegill, and black crappie have been introduced on the eastern shore.

The area of intergradation of the two subspecies of *Hololepis fusiformis* in Maryland would be expected to occur somewhere between their respective ranges. Diligent collecting, however, throughout the north-central and middle portion of the western shore has produced only those *Hololepis* that are recorded above. Hubbs and Cannon (1935) also did not find this genus in collections made for some distance to the north of the locality where *H. f. atraquae* was collected. To the south, however, in Zekiah Swamp, between La Plata and Hughesville, Charles County, Maryland, C. L. and L. C. Hubbs collected 5 adults (UMMZ No. 13602) on May 7, 1937. These forms require a sluggish habitat with dark boggy waters, and in a sense, may be regarded as relict populations.

Sincere appreciation is expressed to Dr. Edward C. Raney of Cornell University, for reading the paper and for verifying the identification of several specimens. Dr. R. V. Truitt, Director, Department of Research and Education, Solomons, and Mr. R. D. Van Deusen and Mr. Harold Elser, Biologists of the same Department kindly checked the manuscript. The 1937 record of *H. f. atraquae* was kindly supplied by Dr. Robert R. Miller of the University of Michigan.—ROMEO MANSUETI, *Department of Research and Education, Solomons, Maryland.*

A STRIPED MARLIN (*MAKAIRA MITSUKURII*) WITHOUT A SPEAR.—On February 9, 1948, while at Otehei Bay, New Zealand, with the Yale–New Zealand Expedition, I was able to examine a striped marlin, *Makaira mitsukurii* (Jordan and Snyder) whose spear had been broken off only a few inches in front of the eye (Fig. 1). Accord-

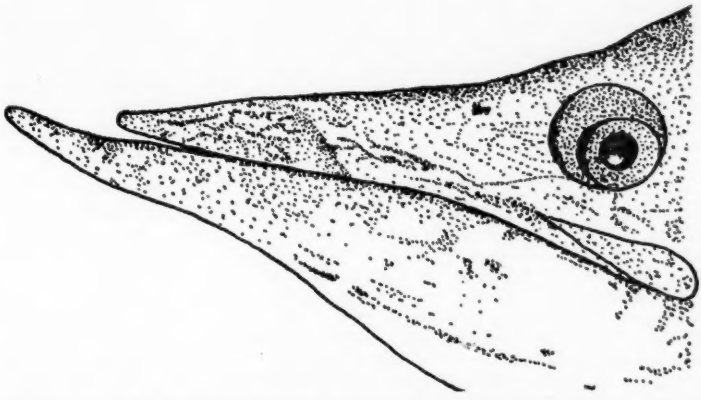


Fig. 1. The head of a striped marlin, showing the broken upper jaw; the lower jaw extends beyond the point of fracture and the injury is completely healed over. Traced and drawn from a photograph.

ing to the angler who caught it, the fish had experienced no difficulty in taking a kahawai (*Arripis trutta*) bait trolled along the surface, had given a good fight and had acted normally in all respects. It was not until the fish leaped, providing a clear view of its head, that the angler and his guide realized that this was not a normal animal.

Although it is customarily assumed that the marlins and other spearfishes rely to a great extent on their spears for obtaining food, it is obvious that the spear is not essential, for the fish in question had evidently suffered the injury some time before being caught. The scar was well healed and completely covered with skin. The break was diagonally across the spear, so that the remaining portion of the upper jaw was several inches longer on the right side than on the left. Because of the arched roof of the mouth at this point, the fish was not able to close its mouth completely. The fish weighed 172 pounds and was 7 feet in standard length. It is probable that approximately a foot of its sword had been lost, for marlins of this weight average about 8 feet long. Thus, another fish, taken two days before, also weighed 172 pounds and was 8 feet 1½ inches in standard length.

The loss of the spear in such fishes is almost certainly the result of ramming some large object. Numerous anglers and fishing guides can testify that spearfishes occasionally ram the boat when being brought to gaff. Gudger (1940, Mem. Roy. Asiatic Soc. Bengal, 12: 215–315) has compiled a large series of authenticated accounts of broadbill swordfish (*Xiphias*) and spearfishes (Istiophoridae) ramming boats, buoys, other fishes, etc. In February, 1950, during the course of the Yale–East African Expedition, Mr. Hugh Copley, chief fish warden of Kenya Colony, British East Africa, showed me a bale of crude rubber, found on a beach near Mombasa, which held the broken spear of a black marlin. This fish must have been traveling at terrific speed when it struck the bale, for the spear appeared to be imbedded 8 or 10 inches into rubber so tough that a man could not drive a spike into it with a heavy hammer.

Although it is not uncommon to find spearfishes with an inch or so broken off the tip of the spear, the capture of a fish with most of the spear missing is a rare occurrence. Gudger (*op. cit.*) recorded only seven instances (2 broadbill swordfish, 5 marlin) of spearfishes that survived or were captured in this condition. One other example was

that of a black marlin reported by Harvey L. Moore (1950, Pac. Sci., 4: 164), who stated, "According to the proprietors of the [fish market] auction, spearfishes without spears have been observed before in the Honolulu market, although such occurrences are very rare."—JAMES E. MORROW, JR., *Bingham Oceanographic Laboratory, Yale University, New Haven, Connecticut.*

THE BIRTH PROCESS OF THE GUPPY, *LEBISTES RETICULATUS.*—Although the viviparous cyprinodonts of the genera *Lebistes, Mollienesia, Platypoecilus* and *Xiphophorus* have been maintained and observed in aquaria for many years, the actual birth process has not been fully described. Since the fry are usually born during the night or early morning, the lack of authentic published reports is understandable. The opportunity to observe the birth process of *Lebistes reticulatus* (Peters) presented itself during studies of the genetics of spinal curvature (1950, Rosenthal and Rosenthal, Jour. Hered., 41: 217).

Purser (1938, Quart. Jour. Micro. Sci., 81: 151) observed that the young *Lebistes* emerged tail first during birth. After a relatively long rest period, the remainder of the body was released by a flick of the female's body. The time taken for each birth, as noted for a single female, required almost 10 minutes. The present note reports the birth process in a female as typical of 15 observations made during the past two years.

On December 26, 1950, the female was transferred to a gallon aquarium of aged water containing a mass of *Ceraptopteris* (water sprite). At 6:50 PM the fish expelled a fry which emerged tail first. The head was released about 40 seconds later. Before the first young was released, the tail of a second appeared. The second fish was born and immediately afterwards a third youngster was born head first. The 3 fry were born in the space of 2 minutes. Each baby fish halted momentarily until the head was released, then quickly gyrated into the vegetation. As succeeding young were born, the head could be seen through the peritoneum to position itself so that it emerged first. The emerging process required almost 4 minutes in one case but usually only a minute or so. Once the head had emerged the young fry virtually shot into the vegetation with explosive force, probably due to their own activity plus constriction of the abdomen by the female. The entire process was watched for 20 minutes during which time 14 young were born as shown below.

Time PM	Number of young	Position at birth
6:50	3	Tail, Tail, Head
6:55	1	Head
7:00	2	Head, Head
7:02	2	Tail, Head
7:03	1	Head
7:05	1	Head
7:06	1	Head
7:10	3	Tail, Tail, Head

The head-first position of emergence is most frequent and presents the usual pattern. Emergence tail first occurs primarily during multiple births and is probably caused by pressure of the unborn young forcing the emerging fry into a more or less "breech" position. The unborn young are invariably curled around the remaining vestiges of yolk sac at the genital pore. Non-viable or dead young are expelled rapidly while in the compact, curled position.

During the birth process, the female assumed a head-down position at an angle of about 15° to 20° with the horizontal. The fins were kept in constant motion but the relative position of the body changed little. Occasionally, the fish arched her body at the moment of birth, but between births, she swam leisurely through the plants or picked food particles from the bottom of the aquarium. As a birth approached, she would swim into a space among the plants which permitted freedom of movement.

The rapidity with which young guppies are born explains the birth of 70 to 80 young in the space of 3 to 4 hours.—HAROLD L. ROSENTHAL, *New Jersey Aquarium Society, Elizabeth, N. J.*

Herpetological Notes

THE HUNTER LIZARD PISTOL.—Some years ago (in the late 1930's) my colleague Colin Campbell Sanborn and I approached our friend Charles Park Hunter, of the Marshall Field Sporting Goods Department in Chicago, for advice as to improvements in our technique of using .22 calibre dust shot cartridges for collecting lizards, bats, and small birds. After a little experimentation, based on the use of aluminum auxiliary barrels in larger shot guns for indoor trap shooting, Mr. Hunter produced a most effective .22 smooth bore pistol with an extension barrel (Fig. 1). Mr. Sanborn and I

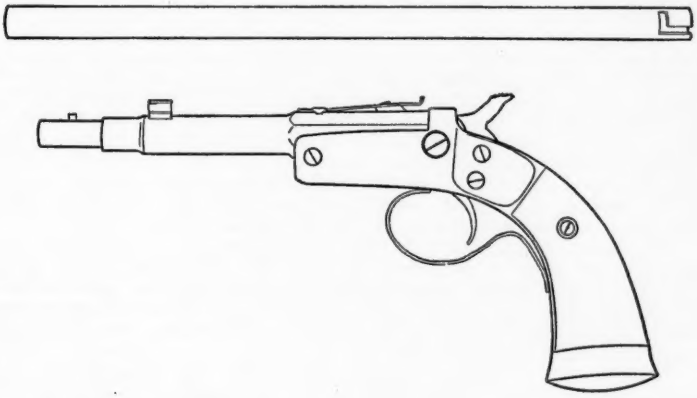


Fig. 1. The Hunter lizard pistol, with detachable extension barrel.

and others associated with the Chicago Natural History Museum have long been referring to this gun as the "Hunter Lizard Pistol." As Mr. Hunter is well known for his interest in shooting big game, it seems peculiarly appropriate to extend his reputation in this way into the field of small game hunting.

For some years we were able to obtain the Stevens target pistol with either 6- or 8-inch smooth bore barrels. This pistol, with all other reasonably priced .22 single shot pistols, seems to have disappeared from the market. On such a barrel Mr. Hunter set the sight back and machined the muzzle to fit an aluminum tube of .36 calibre, with about .005 inch tolerance. A simple slot in the tube slipping past a pin on the cut down muzzle makes it possible to attach or detach the aluminum extension barrel. We have found a 10- to 12-inch length of the aluminum barrel convenient. The original barrel is cut back an inch to take the tube.

The extension barrel approximately doubles the effective range of the long-rifle dust shot cartridge, operating to close the pattern. The ready detachability of the device is especially important, as the more open pattern can be used for close shots, at the 8- to 10-foot range, and the extension makes the pattern about the same at double the distance. The smooth bore gives a much more uniform pattern than can be obtained with a rifled barrel.

On open terrain on the coast of Peru I collected 30 specimens of the coastal lizard *Tropidurus peruvianus* with 30 shots; a shot that missed could be made up for by one that got two lizards at once.—KARL P. SCHMIDT, *Chicago Natural History Museum, Chicago 5, Illinois.*

THE HERPETOLOGY OF THE MISSION MOUNTAINS, MONTANA.—The Mission Mountains, as considered in this paper, include the Mission Range proper, which extends 54 airline miles in a north-south axis, together with the southern extension of hills which is commonly known as the Missoula foothills. In a direct north-south axis, then, the entire Mission Mountains cover 82 airline miles and are separated from the Continental Divide by the Swan Mountains and the Swan and Southfork (of the Flathead) valleys. The mountains are bounded, therefore, on the east by the Swan and Blackfoot valleys; on the south by the Blackfoot River; on the west by the Missoula, Jocko and Flathead valleys; and on the north by the Flathead River. The Missoula valley floor at the south end is at 3250 feet elevation and the Flathead valley floor at the north end is at 2990 feet. The main crest of the range varies in elevation from about 4500 feet in the lower northern end to slightly over 10,000 feet in the peaks near the south end of the main fault. Although no true glacier exists, permanent snow-fields can be found around some of the highest peaks. Within this wide range of altitude, then, there is a great variety of habitats in the montane and sub-alpine forests.

Collecting amphibians and reptiles in the Missions is an arduous and time-consuming task. The Forest Service and Indian Service trails that go over the various passes have not been maintained in the last ten or fifteen years, requiring climbing on foot. To reach most of the passes requires a five- to ten-mile hike and a climb of around 4,000 feet. Trips are usually limited to a part of the summer months because of snow in the high country. Collecting is normally restricted to a short period from mid-day to mid-afternoon, when the reptiles are active. On the east side of the mountains the adjacent primitive area of approximately 120 square miles almost prohibits collecting because of its inaccessibility. Furthermore, for every successful trip taken into the mountains, from one to four trips were taken on which no specimen was collected.

This paper, therefore, does not present a complete picture of the distribution of the amphibians and reptiles of the Mission Mountains, but rather shows progress of four years' effort. The authors are indebted to the many people who have contributed specimens and information, particularly to Dr. Charles Walker and Dr. Norman Hartweg for some of the identifications. This work was made possible by grants from the Research Council of Montana State University.

Inasmuch as it is somewhat difficult to designate the point where the valley floor and the mountains meet, certain proximal ponds and reservoirs have been arbitrarily included and other more remote pond areas have been omitted. Collection points were determined by use of U. S. D. A. Forest Service Maps: (1) Flathead National Forest (Flathead Division), Montana; Principal Meridian, Montana, 1938; and (2) Lolo National Forest (East Half), Montana; Principal Meridian, Montana, 1939. Some of the specimens listed below are in the Montana State University Zoological Museum, and others are in the Museum of Zoology, University of Michigan.

Thamnophis elegans vagrans Baird and Girard

The wandering gartersnake is found in a wide range of altitude and habitat. It is found around most ponds and reservoir areas and even those mountain lakes which have no marshy shores. Its favorite habitats in the higher elevations are the rocky cliffs and the large brush-covered talus slides.

Locality records—*Flathead Co.*: Daphnia Pond, near Bigfork, T26N, R19W, Sec. 6; about 3010 ft.; May 19, 1947. *Lake Co.*: Estes Lake Trail, near Wood's Bay, T26N, R19W, Sec. 20; 3538 ft.; July 20, 1950. Montana State Univ. Biol. Station, T24N, R19W, Sec. 4; 2900 ft.; May 16, 1947. Hellroaring Creek Trail, east of Polson, T23N, R19W, Secs. 35 and 36; 5050 ft.; July 16, 1950. Mud Lake on Courville Trail, east of Pablo, T21N, R19W, Sec. 2; 5340 ft.; June 29, 1950. North Crow Cirque, east of Pablo, T21N, R19W, Sec. 13; and T21N, R18W, Sec. 18; 4477, about 4900, 5167 and 5895 ft.; July 13, 1950. Kicking Horse Reservoir, near outlet of McDonald Cirque, T20N, R19W, Sec. 36; Mar. 18, 1950. McDonald Cirque, southeast of Ronan, T19N, R19W, Sec. 11; June 28, 1949 and June 23, 1950. Mission Cirque, east of St. Ignatius, T18N, R19W, Sec. 12; 3800 ft.; May 2, 1948. St. Mary's Lake, east of Arlee, T17N, R18W, Sec. 6; Aug. 4, 1950. *Missoula Co.*: Gold Creek area, near Bonner, T14N, R17W, Sec. 13; about 5000 ft.; May 7, 1947.

Thamnophis ordinatus parietalis Say

The red-sided gartersnake is as common at lower altitudes as is *T. elegans vagrans*, but as yet, has not been found above 5000 feet elevation. Most of the localities from which

collections were made have characteristic marshy areas. The specimens from North Crow Cirque were found, along with *T. elegans vagrans,* on rocky, brushy hillsides quite some distance from water.

Locality records.—*Flathead Co.*: Daphnia Pond, near Bigfork, T26N, R19W, Sec. 6; about 3010 ft.; May 19, 1947. *Lake Co.*: M. S. U. Biological Station, T24N, R19W, Sec. 4; 2900 ft.; July 7, 1950. North Crow Cirque, east of Pablo, T21N, R19W, Sec. 13; about 4500 ft.; July 11, 1950. Kicking Horse Reservoir, near outlet of McDonald Cirque, T20N, R19W, Sec. 36; about 3100 ft.; Mar. 18, 1950. McDonald Cirque, east of Ronan, T19N, R19W, Sec. 11; June 28, 1949. Mission Cirque, east of St. Ignatius, T18N, R18W, Sec. 7; 3700 ft.; August 8, 1948. Twin Lakes, east of Arlee, T17N, R18W, Sec. 8; August 4, 1950. *Missoula Co.*: Gold Creek area, near Bonner, T14N, R17W, Secs. 13 and 14; about 5000 ft.; May 4, 1947.

Charina bottae utahensis Van Denburgh

The rubber boa is usually found in the large talus slides or under logs and rocks near the slides. Its secretive habits make it a very difficult animal to find, although three specimens were found together, basking in the sun. One snake, a road kill, contained a partially digested *Microtis longicaudus.*

Locality records.—*Lake Co.*: North Crow Cirque, east of Pablo, T21N, R19W, Sec. 14; 4272 ft.; July 11, 1950. Mission Cirque, east of St. Ignatius, T18N, R19W, Sec. 12; 3800 ft.; May 2, 1948; and T18N, R18W, Sec. 7; 3700 ft.; Aug. 8, 1948. *Missoura Co.*: Lower Jocko Lake, east of Arlee, T17N, R17W, Sec. 28; Aug. 4, 1950. Rattlesnake Creek road, north of Missoula, T13N, R19W, Sec. 2; May 12, 1950. Small lake, near Bonner, T13N, R17W, Sec. 3; 3380 Ft.; May 11, 1948.

Gerrhonotus coeruleus principis Baird and Girard

The authors have not yet collected this species in the Missions. However, there is one specimen in the Montana State University Zoological Museum collected by Dr. M. J. Elrod at Teton Mountain in 1901. Descriptions of the position of Teton Mountain indicate that it is the peak south of Mt. Harding, situated in T19N, R19W, Sec. 2; Lake County.

Chrysemys picta belli Gray

The western painted turtle is common to the many glacial potholes of the Flathead valley, but is not found in the oligotrophic waters of the mountains. Two turtles stayed in the bay at the Biological Station during the summer of 1949. These were weighed, marked and released. In the summer of 1950 they were both observed present in the bay during July and August. This species has not been found, to date, at any altitude higher than 3363 feet.

Locality records.—*Flathead Co.*: Pond near Bigfork, T27N, R20W, Sec. 36; 2900 ft. *Lake Co.*: Two ponds on the Estes Lake trail, east of Woods Bay, T26N, R19W, Sec. 20; 3363 ft.; July 20, 1950 (observed, but not collected).

Ambystoma macrodactylum Baird

The long-toed salamander has been found in a wide range of altitudes, usually near pond areas, but sometimes under logs on dry hillsides. Larvae were collected July 28 and October 13, 1946, at one of the smaller lakes at 5550 feet elevation in Mollman Pass. Some of these larvae were taken into the laboratory and reared to adulthood. Larvae were also collected from this lake on August 3, 1950. Hatching eggs were found in Mollman Lake in the pass at 7130 feet elevation on August 3, 1950. An adult was found (specimen not preserved) under a log on the shore of the lake on August 3, 1948. Several larvae, one of which lacked pigment, were collected at Spillway Pond on July 23, 1950; some were preserved and some taken into the laboratory and reared. A newly metamorphosed adult was killed on August 9, 1950.

Locality records.—*Lake Co.*: Cedar Lake, east of Polson, T22N, R18W, Sec. 17; elevation about 7550 ft.; July 25, 1950. Small lake in Mollman Pass, east of Ronan, T20N, R19W, Sec. 24; 5550 ft.; July 28 and Oct. 13, 1946 and Aug. 3, 1950. Spillway Pond at McDonald Lake, east of Ronan, T19N, R19W, Sec. 11; July 23, 1950. Mission Cirque, east of St. Ignatius, T14N, R19W, Sec. 14; 3600 ft.; Apr. 16, 1947. *Missoula Co.*: Mollman Lake, in the pass, T20N, R18W, Sec. 19; 7130 ft.; Aug. 3, 1948 and 1950.

Jewell Lake, in the primitive area, T19N, R18W, Sec. 35; Aug. 11, 1948. Gold Creek area, near Bonner, T14N, R17W, Secs. 13 and 14 (two areas); about 5000 ft.; May 6, 1947. Overflow of Union Creek, near McNamara, T13N, R16W, Sec. 6; about 3500 ft.; Apr. 24, 1950. Small lake near Bonner, T13N, R17W, Sec. 3; 3380 ft.; Apr. 24, 1947.

Bufo boreas boreas Baird and Girard

The northwestern toad has as extensive a range in the Missions, geographically and vertically, as the long-toed salamander. It is as likely to be found on the open rocky hillsides as in the forested areas. Thousands of newly metamorphosed young were observed near a roadside pond south of Woods Bay, on August 5, 1950.

Locality records.—*Lake Co.*: Pond south of Woods Bay, T26N, R19W, Sec. 18; about 3000 ft.; Aug. 5, 1950. Mud Lake, on Courville trail east of Pablo, T21N, R19W, Sec. 2; 5340 ft.; June 29, 1950. North Crow Cirque, east of Pablo, T21N, R18W, Sec. 8; 6530 ft.; July 13, 1950. Mission Cirque, east of St. Ignatius, T18N, R19W, Secs. 12 and 14; 3700 ft.; May 2, 1948 and Apr. 6, 1947. Biological Station grounds, T24N, R19W, Sec. 4; Summers, 1946–50 (Observed, but none preserved). *Missoula Co.*: Gold Creek area, near Bonner, T14N, R17W; Sec. 13; about 5000 ft.; May 6, 1947. Small lake near Bonner, T13N, R17W, Sec. 3; 3380 ft.; Apr. 24, 1947.

Ascaphus truei montanus Stejneger

To date, the belltoad has been found only in the Missoula foothills, but further investigations should show it to be present in most of the fast water streams of the Missions. Two tadpoles and two adults were collected at Marshall Creek.

Locality records.—*Missoula Co.*: Rattlesnake Creek north of Missoula, one mile above Franklin Ranger Station, T14N, R18W, Sec. 13; about 4400 ft.; May 14, 1948; Above Sawmill Gulch, T14N, R19W, Sec. 35; 3600 ft.; May, 1949. Spring on Gold Creek, near Gold Creek Ranger Station, T14N, R16W, Sec. 7; about 4200 ft.; May 4, 1947. Marshall Creek, T13N, R18W, Sec. 6; Apr. 23, 1949.

Hyla regilla Baird and Girard

As in the belltoad, collection records probably do not show the distributional pattern of the Pacific treetoad. Collections are usually limited to the breeding season. Except for one specimen collected in July, 1916, by Dr. M. J. Elrod at "Estey pond" (which the authors assume to be Estes Lake in the extreme northern part of the Missions), all specimens to date were collected in the extreme southeastern end of the Missoula foothills. Breeding adults were collected near Bonner on April 24, 1947, and others were observed during the breeding season every year since then.

Locality records.—*Missoula Co.*: Roadside slough near Bonner, T13N, R17W, Sec. 3; 3380 ft.; Apr. 24, 1947. Overflow areas of Union Creek at McNamara, T13N, R16W, Sec. 6; about 3500 ft.; May 18, 1948 and Apr. 24, 1950. Ponds in Gold Creek area, near Bonner, T14N, R17W, Sec. 13; about 5000 ft.; May 6, 1947 and May 17, 1950.

Rana pipiens Schreber

Specimens of the leopardfrog have been found in four localities.

Locality records.—*Lake Co.*: Estes Lake Trail, east of Woods Bay, T26N, R19W, Sec. 20; 3363 and 3538 ft.; July 20, 1950. Roadside pond, south of Woods Bay, T26N, R19W, Sec. 18; about 3000 ft.; July 1, 1950. Kicking Horse Reservoir, below McDonald Cirque, T20N, R19W, Sec. 36; Mar. 18, 1950. Spillway pond at McDonald Lake, east of Ronan, T19N, R19W, Sec. 11; June 28, 1949 and June 23, 1950.

Rana pretiosa pretiosa Baird and Girard

The western spotted frog was collected in areas ranging from 3500 to 5550 feet in altitude.

Locality records.—*Lake Co.*: Two lower lakes of Mollman Pass Trail, east of Ronan, T20N, R19W, Sec. 24; 5365 and 5550 ft.; Aug. 3, 1950. Spillway pond at McDonald Lake, east of Ronan, T19N, R19W, Sec. 11; June 28, 1949 and June 23, 1950. *Missoula Co.*: Lower Jocko Lake, east of Arlee, T17N, R17W, Sec. 27; Aug. 4, 1950. Ponds of Gold Creek area, near Bonner, T14N, R17W, Secs. 13 and 14; May 6, 1947. Overflow of Union Creek near McNamara, T13N, R16W, Sec. 6; about 3500 ft.; May 18, 1948 and Apr. 24, 1950.—ROYAL BRUCE BRUNSON and HERALD A. DEMAREE, JR., *Department of Zoology, Montana State University, Missoula, Montana.*

COURTSHIP AND MATING OF THE FOXSNAKE, *ELAPHE VULPINA VULPINA*.—I had the opportunity to witness several complete courtships of the foxsnake last summer at the Black Hills Reptile Gardens. These snakes, average length, 2½ feet, were received in late spring and were in good condition throughout the period of observation. All courtships followed the same pattern and they occurred between June 30 and July 18. The eggs were laid in late July and August; all eggs examined were fertile.

The male on first spying the female would remain motionless for a period of 10 to 30 seconds, with only the tongue flicking in and out. After this the male would follow the female at a fairly fast rate until his head was next to the base of her tail. He would then rub his chin shields along the dorsal scales at the tail base. This procedure would continue from 2 to 20 (average 5) minutes, and then the male would seize the female immediately behind the head and quickly wrap his body around hers. The period of intercourse was fairly constant varying only 3 or 4 minutes from the average of 20 minutes. While the courtship procedure was the same each time, in five instances intercourse did not take place. In four of these exceptions, the male was from 4 to 8 inches longer than the female, and in one the male was 5 inches shorter. However, each of these succeeded in mating with snakes nearer its own length. I assume, therefore, that approximately equal length is necessary for successful courtship and intercourse in this species.—WALTER E. SIMONSON, *5104 26th Avenue So., Minneapolis 17, Minnesota.*

THE MARBLED SALAMANDER, *AMBYSTOMA OPACUM* (GRAVENHORST), IN MICHIGAN.—On July 18, 1950, an adult specimen of *Ambystoma opacum* was taken from under a log at Camp Blackhawk, 2½ miles north of Buchanan, Berrien County, Michigan, by Halsen Schurston and was given to the senior author. This species is included in the Chicago area (Edgren and Stille, 1948, Nat. Hist. Misc., 26: 1–7) on the basis of specimens from LaPorte County, Indiana, which is adjacent to Berrien County, Michigan. The present record appears to be a slight northern extension of the known range and the first record of the occurrence of this species in Michigan.

This specimen, Ill. Nat. Hist. Surv. No. 5732, is a male, 62 mm. from snout to vent, with 12 costal grooves, four transverse bands on the body and seven on the tail.—HARLAN WALLEY, *621 East Center Street, Sandwich, Illinois,* and PHILIP W. SMITH, *Natural History Survey, Urbana, Illinois.*

A PRACTICAL SOLUTION OF THE NOMENCLATURE OF THE COMMON GARTERSNAKE AND THE RIBBONSNAKE.—A solution to the present confusion in nomenclature caused by dual usage of the name *Thamnophis sirtalis* (Linnaeus) has recently been discussed (1950, COPEIA (1): 58) and officially proposed (1951, *Bull. Zool. Nomencl.*, 2 (3): 67–69) by Schmidt and Conant. However, due to the time elapsed and in the belief that even more confusion would ensue with the re-reversal of the names *T. sirtalis* and *T. sauritus,* an alternative solution is herein presented.

In the Tenth Edition of the *Systema Naturae,* Linnaeus (1758: 222) gave the name *Coluber sirtalis* to a snake collected in Canada by Peter Kalm. This snake was described as having 150 ventrals and 114 caudals, and thus, as pointed out by Klauber (1948, COPEIA (1): 8–10), certainly refers to the ribbonsnake of North America.

In the Twelfth Edition of the *Systema Naturae,* Linnaeus again described this species (not an unusual occurrence), this time as *Coluber saurita* 1766: 385), based upon a specimen collected by Alexander Garden in "Carolina." Another specimen collected by him in "Carolina" was the basis for the name *Coluber ordinatus* Linnaeus (1766: 379); this species was early recognized as a non-striped gartersnake (since shown to be a color phase of the common gartersnake).

However, Harlan (1827, *Jour. Acad. Nat. Sci. Philadelphia,* 5: 352; and 1835, *Medical and Physical Researches.* Philadelphia: 116) tentatively (and mistakenly) applied the name *Coluber sirtalis* Linnaeus to the striped phase of the common gartersnake, saying that it had been "Hitherto not accurately described," and retained the name *Coluber ordinatus* for another color phase. The application of the trivial name *sirtalis* to the

common gartersnake (striped phase) was questioned by Holbrook in his *North American Herpetology* (Philadelphia, 1840, 4: 91 [Klauber, not seen], and 1842, 4: 43–4) but he used it nevertheless, believing that Linnaeus would not have first described the ribbonsnake as *C. sirtalis* and later as *C. saurita*, and since the latter name definitely referred to this snake, that the former, therefore, must refer to the common gartersnake. The lingering doubts of this application were dispelled by continued usage through the years, everyone apparently basing his work upon that just previous, rather than upon the original descriptions.

Thus, through many years of usage, the trivial name *saurita* (now used in the combination *Thamnophis sauritus*) has become the accepted name for the ribbonsnake. The common gartersnake, however, has had *two* names applied to it for most of this time (this was not pointed out by Schmidt and Conant). The trivial name *ordinatus* was correctly applied, but restricted to the non-striped color phase, until Ruthven (1908, *Bull. U. S. Nat. Mus.*, 61: 176) synonymized it with *Thamnophis sirtalis* (*auct.*); the latter name, previously restricted to the striped phase, then became (erroneously) the only one recognized for this species. It retained this position until the appearance of Klauber's work in 1948.

In the interval between the appearance of Klauber's work (April 22, 1948) and the present date, the name *Thamnophis sirtalis* (Linnaeus) has been used by different authors to refer to both the ribbonsnake and the common gartersnake. A census of the two American herpetological journals since 1948 is sufficient to demonstrate the present confusion. In the journal of the American Society of Ichthyologists and Herpetologists the name *Thamnophis sirtalis* has been applied to the common gartersnake in one paper (1950, COPEIA (3): 233–34), to the ribbonsnake in one (1951 (1): 79) and in one the intended species cannot be determined from the text (1950 (3): 229). In the other journal the name is more frequently used, and thus more confused; *Thamnophis sirtalis* was applied to the common gartersnake in three cases (*Herpetologica* 5: 86; 6: 71–4, 97–100), to the ribbonsnake in two (5: 17, 89), and one usage is indeterminate (5: 119).

The name *Thamnophis ordinatus* has been used recently for the common gartersnake in both journals (1951, COPEIA (1): 54, and *Herpetologica* 5: 49–50; 6: 87, 88, 121, 145, and subsequently) as well as in Perkins' recent *Key to the Snakes of the United States* (*Bull. Zool. Soc. San Diego*, 24) which has wide distribution. To revive the name *Thamnophis sirtalis* for this snake now will merely cause further confusion.

I have, therefore, proposed to the International Commission on Zoological Nomenclature that (1) it use its plenary powers to suppress the trivial name *sirtalis* Linnaeus, 1758 (described as *Coluber sirtalis*), which was originally applied to the ribbonsnake (as shown by Klauber, COPEIA, 1948: 8–10), but which was mistakenly applied to the common gartersnake for a long period of time, and further, to place it on the *Official Index of Rejected and Invalid Specific Trivial Names in Zoology;* and (2) it place the trivial names *ordinatus* Linnaeus, 1766, and *saurita* Linnaeus, 1766 (both originally published as the binomials *Coluber ordinatus* and *Coluber saurita*, and both now recognized as belonging to the genus *Thamnophis* Fitzinger) on the *Official List of Specific Trivial Names in Zoology*. Thus, the common gartersnake would be known as *Thamnophis ordinatus;* the ribbonsnake as *T. sauritus*.

It should be pointed out that if the proposal of Schmidt and Conant is followed, it will necessitate the artificial linking of the name of one animal with the original description of another. This would mean that workers could not base their idea of this species upon the original description, thus putting our system of nomenclature into an awkward position. Furthermore, it would prolong the present confusion over the name *Thamnophis sirtalis*. If the present proposal is followed on the other hand, only the suppression of a single name is necessary, an action for which there is ample precedent.

The application, as outlined above, will be published by the Commission in its *Bulletin of Zoological Nomenclature* and will be considered jointly with the Schmidt-Conant application already published. On behalf of the Commission, its Secretary has accepted the suggestion that notice of this application be offered to the present journal in view of its wide distribution. Specialists are particularly asked to submit their views on this case to the Commission through its secretary, Francis Hemming, 28 Park Village East, Regent's Park, London, N.W. 1, England. Each communication should be clearly marked with the Commission's Reference Number, Z.N. (S.) 433.—HERNDON G. DOWLING, *Department of Biology, Haverford College, Haverford, Pennsylvania.*

THE TYPE LOCALITY OF THE MEDITERRANEAN GECKO, *HEMIDACTYLUS T. TURCICUS* (LINNAEUS).—In a recent paper, Smith and Taylor restrict the type locality of the Mediterranean gecko to Cairo, Egypt (1950; Univ. Kansas Sci. Bull., 33 (2)(8): 314). Such action is unwarranted. Linnaeus described the form in the 10th edition of the *Systema Naturae;* he called it *Lacerta turcica,* meaning "Turkish lizard." Of the range of the form, he remarked only *"Habitat in Oriente,"* but he clearly indicated the provenance of his material in his choice of a specific name. Therefore the type locality of *Hemidactylus t. turcicus* is Turkey, not Egypt. Mertens and Müller, in the 2nd (1940) edition of the European checklist, give the *terra typica* of the form as "Türkei"; this alone may be considered a restriction of the type locality antedating that of Smith and Taylor.—WILFRED T. NEILL, *Research Division, Ross Allen Reptile Institute, Silver Springs, Florida.*

DARK COLORATION IN THE REPTILES OF THE MALPAIS OF THE MEXICAN BORDER.—A study of the reptiles of the Tularosa "malpais," or black lava country of New Mexico made in 1949 (Lewis, 1949, COPEIA (3): 181–84) allowed some tentative statements concerning melanism and its relationship to the color of the environment. It was found that endemic reptiles tended to be colored like their substrate, that the coloration was protective, probably genetic in character and of probable significance in natural selection. Protective coloration seemed to precede thermostatic coloration in importance.

In the summer of 1950 we were able to spend several weekends examining lava beds a few miles north of the Mexican border in the Novia, Afton, and Eden quadrangles of Dona Ana County, New Mexico (United States Geological Survey maps). The lava here was similar to that of Tularosa in color and texture but was much more discontinuous, with intervening areas of fine sand and mesquite bush desert typical of the Chihuahuan biotic province. Eight reptilian species were collected, and are referred to by the field number.

Urosaurus ornatus linearis (Baird).—This was the commonest lizard of the lava. The dorsal color of collected specimens was black, with a very dimly marked pattern. The chin and the lateral aspects of the base of the tail were pinkish-orange. The lizards blended very precisely with the lava color, and usually escaped into rock crevices before they could be shot.

Uta stansburiana stejnegeri Schmidt.—Specimens observed in the field appeared identical with those of "normal" colored areas. No color or morphologic differences were found between two collected specimens (No. 302, 304) and a series from the Tularosa basin in Dona Ana County.

Sceloporus magister magister Hallowell.—One small individual, No. 263 (40 mm. snout-vent length), was shot on the lava of the Kilbourne crater. The dorsal color was not black, but distinctly darker than that of comparison populations.

Crotaphytus wislizeni wislizeni Baird and Girard.—One 315-mm. specimen (No. 264) was shot on a yellow sandstone shelf exposed at the edge of Kilbourne crater. It was of standard color tone and pattern. The stomach contained a small *Cnemidophorus tigris tigris* Baird and Girard.

Crotaphytus collaris baileyi Stejneger.—A 204-mm. specimen was collected on the Afton lava. The tail bore a regenerated tip. The dorsal color was heavily suffused with black, the collars were wide and jet black, and the ventral surfaces finely speckled with dull brown.

Cnemidophorus tigris tigris Baird and Girard.—The race runners collected at Afton (No. 221, 224, 232, 233) and at Kilbourne Hole (No. 230, 231) were similar in coloration to a comparison collection from the mesquite desert to the north. These lizards run fast and far when disturbed. Their course is invariably off the lava and into the mesquite and sand dune areas, where they enter holes or sprint from one bush to another. They are better adapted to fine sand than to rocky terrain in locomotor function at least, and none of the specimens showed increase in dark pigment of scutellation or other indication toward adoption of the lava as a permanent environment.

Crotalus atrox Baird and Girard.—No. 225 (91.7 cm. total, 81.0 cm. snout-vent length) was encountered crossing a small lava field near Afton in midday. The approximately normal color made it very conspicuous on the black rock, and was reflected in the

snake's hyper-anxious efforts to escape to the nearby sand dunes. The dorsal pattern was obscure, and a faint pinkish suffusion marked the posterior one-third of the body.

Terrapene ornata (Agassiz).—A bleached carapace was found on the rim of Kilbourne Hole. Almost all coloration of the epidermal scutes had been destroyed by exposure to the sun.

This small collection supports the postulates developed for the Tularosa population. Three of the four genera which have taken up a permanent abode on the lava show marked melanotic changes. *Uta* appears to be an exception. No morphological variation of subspecific magnitude was noted. The specimens are now at the Museum of Natural History, College of Puget Sound, Tacoma, Washington.—THOMAS H. LEWIS, *U. S. Naval Hospital, San Diego 32, California.*

AGE OF THE BOXTURTLE, *TERRAPENE CAROLINA CAROLINA* (LINNAEUS).—Many records, having greater or less reliability, are reported concerning the age, size and growth of this reptile. The following is a case of unusually high authenticity. Mr. O. J. Porter, a farmer of the Centertown section near Hartford, Ohio County, Kentucky, reports the facts by letter and through the columns of the *Ohio County News* of Hartford. The newspaper story is factual, told without journalistic embellishment, and vouched for by Mr. Porter.

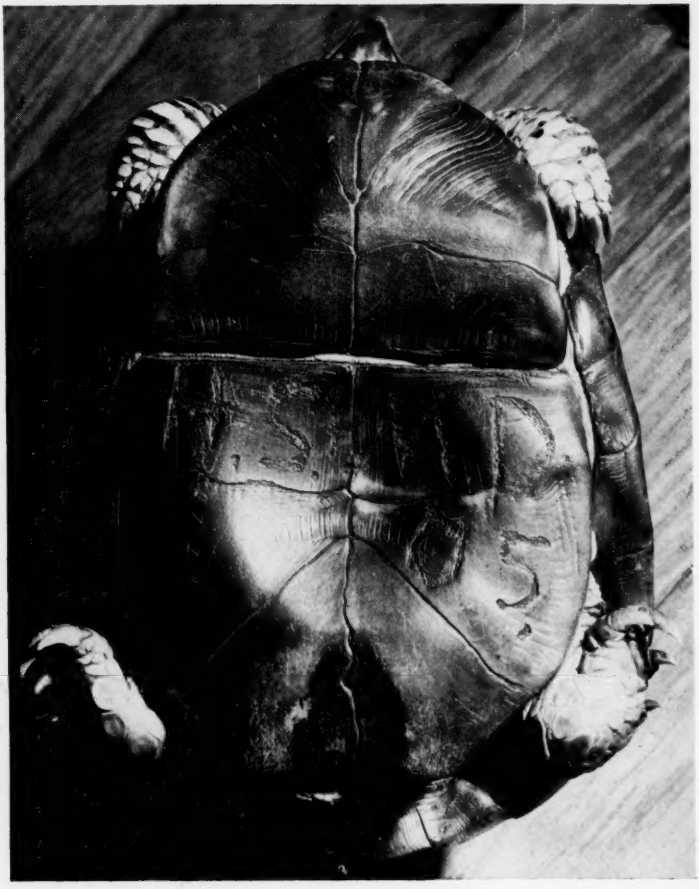
The tortoise, apparently female, bears the date 1887 and the initials RHB inscribed by the hand of Mr. Porter's father-in-law, Mr. Robert H. Brown. It had been picked up a second time in the same five-acre field by Mr. Brown. The third recovery was made in the same field by Mr. Porter in 1932, who showed it to Mr. Brown and had from him the fill-out on the story. Mr. Porter added his initials, "OJP," and again released the turtle. An unknown person picked it up and cut the letters RC and the date 1934 after that. Since the death of Mr. Brown in April, 1951, Mr. Porter has again recovered the animal, and besides releasing the story to the newspaper has submitted the specimen to the undersigned. From the above it is seen that the animal's age may be set at 64 years plus.

The measurements follow: length of plastron, 133 mm.; center length of carapace, 138 mm.; greatest width of carapace, 104 mm.; height of shell, 68 mm.; weight after a week's desiccation, 512 g.; weight after a night, plastron-deep in water, 532 g.—J. M. EDNEY and W. R. ALLEN, *Department of Zoology, University of Kentucky, Lexington, Kentucky.*

A HALF-CENTURY-OLD BOXTURTLE, *TERRAPENE CAROLINA CAROLINA* (LINNAEUS), FROM NORTHERN OHIO.—On April 28th, 1951, a boxturtle (Plate I) was found by Mr. Herman Sickenger in a woods on the family farm near Milan, Erie County, Ohio, where Mr. Sickenger was raised. The turtle's plastron clearly bears the initials H. S. + M. D., and the date, '05. Mr. Sickenger recalls that in the spring of 1905, during his courtship of his wife, then Madelaine Doane, he carved the two sets of initials and date on some boxturtles in this same woods and released them. Subsequently the family farm was sold; Mr. Sickenger now resides in Milan.

Under the circumstances outlined above, this turtle found in April, 1951 in the same woodlot in which it was released in 1905, bearing the same initials as carved by Mr. Sickenger in that year, and then recognized by him as probably the same turtle, lends considerable authenticity to this record. Mr. Sickenger recalls that the turtles on which he carved initials in 1905 were almost as large as the one recovered. Assuming this turtle was essentially adult and several years of age at that time, it seems justified to estimate the present age as a full half century.

Incidentally, the original photographs, made by P. A. Ewell, Milan, Ohio, and supplied me by a student, Charles H. Fisher, also from Milan, show concentric lines on both the anterior right costal and the anterior left humeral corneoscutes of the carapace and plastron respectively, distinct enough to be counted. They both yield a count of 25 "annular" markings.—JOHN W. PRICE, *Department of Zoology and Entomology, Ohio State University, Columbus 10, Ohio.*



Ventral view of boxturtle showing initials H. S. + M. D. carved in the plastron in 1905 by Herman Sickenger.

FOOD OF THE BLACK-BANDED SNAKE, *CONIOPHANES IMPERIALIS IMPERIALIS* BAIRD.—Schmidt and Davis (1941, Field book of snakes: 265) state that the food of the black-banded snake is "probably lizards." Because of the paucity of information on the food habits of this snake, the following record seems worthy of note. On June 9-10, 1950, Fred Nyc, a student of mine, captured several specimens of *C. i. imperialis* near Brownsville, Texas. One of them contained in its stomach the remnants of the hind quarters of a frog, tentatively identified as *Leptodactylus labialis* on the basis of no webs on the hind feet and the slender tips of the digits.—WILLIAM B. DAVIS, *Department of Wildlife Management, College Station, Texas.*

NEW LOCALITY RECORDS OF REPTILES IN NEW MEXICO.—While collecting reptiles in August, 1950, in the region around Roswell, New Mexico, the following new records for the area were discovered. Field headquarters was the new Biological Station at the New Mexico Military Institute.

Holbrookia maculata maculata (Girard). A number of these lizards were taken near Roswell.

Eumeces taylori Smith. One specimen of the Pecos skink was caught on a cloudy cool afternoon in grass a few miles southwest of Roswell.

Thamnophis ordinatus parietalis (Say). One specimen of the red-sided gartersnake was picked up at Wades Swamp, near Artesia.

All turtles except the ornate boxturtle were caught in traps in the Bitter Lakes Wildlife Refuge, about 12 miles northeast of Roswell: *Kinosternon flavescens flavescens* (Agassiz), *Terrapene ornata* (Agassiz), *Pseudemys scripta troosti* (Holbrook), *Pseudemys floridana texana* (Baur) and *Amyda emoryi* (Agassiz).

I wish to express my appreciation to the Carnegie Fund for the Advancement of Teaching and to Transylvania College for financial aid which made my study possible.—ROY E. BUNDY, *Department of Zoology, University of Wisconsin, Madison, Wisconsin.*

POPULATION DENSITY OF SNAKES ON PENIKESE ISLAND, MASSACHUSETTS.—That snakes, under certain conditions, may attain a high density of population was illustrated in a study made in Chicago by the writer (1950, COPEIA (3): 229–30). Another reference to dense populations was recently encountered and since it may not come to the attention of herpetologists, it was thought worthy of recording in this journal. Floyd (Bird-banding, 3: 173–74), in discussing the disappearance of nesting terns from Penikese Island, Massachusetts, mentions the large number of gartersnakes (*Thamnophis sirtalis sirtalis*) on the island. The snakes had been introduced for experimental purposes and with the apparent lack of natural predators, they have flourished to a considerable extent. The warden of the island killed 550 snakes within a short period: (April 15, 1932 (65); April 18 (165); April 20 (175); April 21 (40); April 22 (45); and April 23 (60). An inquiry was addressed to Mr. Hagar, ornithologist for the Massachusetts Department of Conservation, who kindly supplied the following information. The island consists of about 65 acres, 60 of which are suitable for snakes. Accordingly, the average number of snakes would be 9.2 per acre. It is to be noted, however, that the number of snakes being killed was not diminishing, and also, according to Mr. Hagar, the snakes were still numerous in 1948 when he last visited the island. Using the proportion of captured snakes to the theoretical total that was calculated to hold for the Chicago population (*op. cit.*), the total number of snakes on Penikese comes to 2020, or about 34 per acre. This is about one-tenth the density found in my previous study but is nevertheless a considerable one. Lest anyone uncritically accept this value, let it be emphasized that its calculation is practically guess-work; there is no suitable method of evaluation.—HENRI C. SEIBERT, *Department of Zoology, Ohio University, Athens, Ohio.*

REVIEWS AND COMMENTS

TAXONOMIC KEYS TO THE COMMON ANIMALS OF THE NORTH CENTRAL STATES EXCLUSIVE OF THE PARASITIC WORMS, INSECTS AND BIRDS. By Samuel Eddy and A. C. Hodson. Burgess Publishing Co., Minneapolis, Minnesota. Rev. Ed., 123 pp., 613 line drawings. 1950. $2.00.—The area embraced by this work is the region north of the Ohio River, but its boundaries are not delimited. These keys are not intended to replace the larger standard reference works but are designed for use by those who do not have such works available.

The section on fishes covers pages 69 to 86 and includes 73 line drawings; that on amphibians and reptiles covers pages 87 to 96, with 26 drawings. The keys to the lampreys and fishes do not include the Cyprinidae, thereby reducing their usefulness to the advanced student or professional worker. The keys are in general well prepared, the nomenclature is modern and the drawings are good. A few errors seem inevitable but most of these are obvious and either typographical or due to careless checking. As a result of recent changes in the International Rules of Zoological Nomenclature, the specific trivial name of the brook lamprey should be written *lamottei* (not *lamottenii*), the American eel should be called *Anguilla rostrata*, the rainbow trout should be written *Salmo gairdneri*, the white sucker *Catostomus commersoni*, the black crappie *Pomoxis nigromaculatus* (no hyphen), and the mottled sculpin *Cottus b. bairdi*. The correct spelling of the family name of the lampreys is Petromyzontidae. These minor corrections can be included in the next revised edition.

The section on amphibians and reptiles is well-done in general. Since the area embraced is in the "north central states, or the region north of the Ohio River" the authors won't please all herpetologists by their choices of specific inclusions and exclusions. *Agkistrodon piscivorus* is recognized as belonging within the area, but *Sceloporus undulatus* is not. *Kinosternon flavescens* and *K. subrubrum*, both well within the nebulous boundaries of the area, are omitted; *Chrysemys picta picta*, an eastern form, is included. Some forms are keyed to species; others, to subspecies. The varied choice of scientific names shows that the authors were exercising judgment, or that their bibliographic sources were incomplete. Perkins' key to the snakes should have been cited in the bibliography.—ROBERT RUSH MILLER and NORMAN HARTWEG, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

A SOURCE BOOK OF BIOLOGICAL NAMES AND TERMS. By Edmund C. Jaeger. Charles C. Thomas, Publisher, Springfield, Illinois, 1950: xxxv + 287, illus. 2nd ed. $4.50.—The first edition of this book (reviewed in COPEIA, 1945 (1): 57) was well received, and the revised edition should enjoy even wider usage because of the general increasing interest in science during the past decade. More than 1800 new word elements have been added in the present edition, thereby increasing the total pagination by nearly 70 pages. The elementary principles of word building are set forth in the Introduction. For proposing as well as emending names, it would have been helpful if genders had been given. Certain differences between the international rules of zoological and botanical nomenclature prompt me to voice a criticism stated by the reviewer of the first edition, namely that this section could have been expanded to bring in something of the zoological rules.

This book should be on the desk of every student of systematic biology and it is highly recommended for use by scientists as well as non-scientists.—ROBERT RUSH MILLER, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

THE SEA AROUND US. By Rachel L. Carson. Oxford University Press, N.Y., 1951:vii + 230, 4 figs. $3.50.—This delightful and authoritative volume will be read with enjoyment and profit by scientist and layman alike. Although in no sense a textbook, it has been organized with reference to the best available literature and reviewed in manuscript by recognized authorities. Brought to life by Miss Carson's literary skill, each chapter stands by itself as a masterful essay on one aspect of the fascinating story of the sea.

The book is divided into three parts. The first traces the history of the earth, describing the origin of the moon, the development of the ocean basins, and the formation of the prehistoric seas. The author explains the origin of life and follows its evolution through the ages to the great complexity of modern animals and plants. The variety of life in the ocean, its dependence on currents and temperature, and its response to the changing underwater seasons, are pictured with remarkable clarity. The chapters dealing with life in the ocean depths, the topography of the sea bottom, the sediments, the birth of an island, and the geological changes that have occurred throughout the ages to recent times, represent popular scientific writing at its best.

Part two deals with waves, the permanent ocean currents, and the tides. These types of water transport are described in relation to their effects on plant and animal life. The effects of wind, sun, moon, and the rotation of the earth on these massive water movements are treated in simple, non-technical fashion.

The theme of part three concerns the close relationship between man and the sea about him. The author explains how the ocean functions as a thermostat, regulating the temperature of the land and buffering the great extremes of temperature that otherwise would prevail. She pictures its waters as a great storehouse of minerals, some of which are extracted in commercial quantities; as the medium in which the world's oil resources were laid down; and as the source of a significant part of the supply of protein food. Of necessity, it was over the oceans that the great trade routes were established, and in her concluding chapter the author imparts the fascination of man's early explorations, and the evolution of his charts and sailing directions.

The author cannot be criticised for the few errors that have crept into a work so vast in scope. The book is a welcome and valuable addition to oceanographic literature.—J. L. McHugh, *Virginia Fisheries Laboratory, Gloucester Point, Virginia.*

SURVEY OF MARINE FISHERIES OF NORTH CAROLINA. By Harden F. Taylor and a staff of associates. The University of North Carolina Press, Chapel Hill, 1951, xii + 555 pp.: $10.00—The purpose of this survey was to provide a foundation for future research by assembling and summarizing all available information on the marine waters and their fisheries in North Carolina. In the accomplishment of that end Dr. Taylor and his associates have produced a unique volume—one that should stand long as a useful reference and as a basis for lively argument.

Part I, a digest by Nelson Marshall of data on the hydrography of oceanic and estuarine waters of the state, contains also speculation as to whether the low percentage (0.08) that North Carolina's highest annual fishery yield constitutes of the estimated basic (plant) productivity may not indicate underexploitation of the resource.

Part II, a series of articles on economic species, includes chapters on menhaden (William A. Ellison, Jr.), edible finfishes (Eugene W. Roelofs), oyster and other mollusks (Alphonse F. Chestnut), shrimps (Carter Broad), blue crab (John C. Pearson), diamondback terrapin (Robert E. Coker), seaweeds (Harold J. Humm), and marine angling (Francesca LaMonte). Summarizations of widely scattered and often fragmentary data on the various species are generally good and the bibliographies extensive.

Part III, a voluminously documented treatment by Taylor of the economics of fisheries in general and North Carolina fisheries in particular, does violence to many traditional beliefs and attitudes. Even those who are pained most deeply by arguments that total production of fishery products is limited only by demand and fluctuates with business cycles, that no major regional fishery of the United States (except possibly the Great Lakes) has been exploited to the point of diminishing returns, that economic determinants regulate fishing pressure automatically to prevent exhaustion of stocks or extinction of species, that obsessions with destruction of small fish, fear of depletion, and estimates of theoretical optimum yield are unrealistic, and by like iconoclastic remarks, will benefit none the less by having it forced upon them that economic as well as biological considerations must enter into the interpretation of changes in the fisheries and into planning for their rational exploitation.

On other points disagreement will be less. Most will agree, for example, that the fishing industry is beset with complex economic problems, many of them inherent in the very nature of fisheries, and that improvement can come about only slowly and as the result of

well directed effort. Nor will many take issue with Taylor's insistence that investigations concentrated on single species are to a large degree futile and that effective research calls for studies of whole populations, even of the complete chain of productivity from the diatom to the economically exploitable organism. Here it can be said in defense of starveling fishery biologists that inadequacies in their research programs often reflect budgetary stringencies rather than narrowness of viewpoint.—RALPH HILE, *Fish and Wildlife Service, U.S. Department of the Interior, Ann Arbor, Michigan.*

ALGAE OF THE WESTERN GREAT LAKES AREA (exclusive of desmids and diatoms). By G. W. Prescott. Cranbrook Institute of Science, Bloomfield Hills, Michigan, Bull. No. 31 (printed as No. 30, subsequently corrected), 1951: 946 pp., 136 pls., $10.50.—A monumental work on the algae of the region. There are short, introductory essays on the distribution and ecology of algae with particular reference to waters in Wisconsin. Most of the book is an extensive systematic treatment of keys and morphological descriptions for species, followed by an analytical key to genera, glossary, bibliography and an index.

NATURE'S WAYS. By Roy Chapman Andrews. Crown Publishers, Inc., N.Y., 1951: 206 pp., 170 illus. (69 in color). $3.75.—This is a very attractive presentation, written in popular style, of the more interesting kinds of animals that have been selected to demonstrate how they are fitted for survival. An unusual feature is a "Classified Table of Contents" in which the animals discussed are listed according to their most notable means of protection (mimicry, speed, smell, symbiosis, etc.). The color plates are striking. Those laymen who have not been privileged to travel widely will appreciate *Nature's Ways,* which was written for the American public and will entertain both young and old.

New Bulletin Marine Science

IN response to the need for a regional journal for the growing volume of marine research along the coasts of the Gulf states, the Atlantic coast of Florida and the West Indies, the *Bulletin of Marine Science of the Gulf and Caribbean* is being published by the University of Miami Press.

The Editorial Board is representative of the various marine sciences and also of the geographical area:

Robert H. Williams, Editor, University of Miami
John H. Davis, Jr., University of Florida
Luis Howell Rivero, University of Havana
Dale F. Leipper, Agricultural and Mechanical College of Texas
Norman Millott, University College of the West Indies
Hilary B. Moore, University of Miami
Charles M. Pomerat, University of Texas
Luis R. Rivas, University of Miami
Waldo L. Schmitt, United States National Museum
F. G. Walton Smith, University of Miami

Papers dealing with marine biology, physical and chemical oceanography, and submarine geology, either directly or indirectly related to the region, will be considered for publication. It is anticipated that contributions will have considerably more than local significance, however, and that the investigations reported will be of general interest to all concerned with the marine sciences.

Papers appearing in the first number, which is now off the press, include (abbreviated titles):

Distribution of oceanic birds, by H. B. Moore
Metamorphosis of barnacles, by H. D. Doochin
Oyster taxonomy, by G. Gunter
Marine borer attack and illumination, by L. B. Isham, F. G. W. Smith and V. Springer
Florida cephalopods, by G. L. Voss
Diseases of oysters, by J G. Mackin

Inquiries should be addressed to the Editor, at the Marine Laboratory, University of Miami, Coral Gables (University Branch), Florida.—Robert H. Williams.

EDITORIAL NOTES AND NEWS

Western Division Meeting

THE 20th annual meeting of the WESTERN DIVISION, AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS, was held on June 18-20, 1951, at the University of Southern California, Los Angeles, as part of the annual meeting of the PACIFIC DIVISION of the AAAS. In ichthyology there was a symposium on "Methods of Collection and Field Study of Fishes" and a half day of submitted papers. In herpetology, in a joint session with the HERPETOLOGISTS LEAGUE, there was a symposium on "Herpetological Life Histories" and a half day of submitted papers.

There was one student award in ichthyology: first prize to ANDREAS B. RECHNITZER, Scripps Institution of Oceanography, La Jolla, California, for a paper on "Pressure versus fishes." There were two awards in herpetology: first to KENNETH S. NORRIS, Van Nuys, California, for a paper on "*Bipes*: Baja California and Arizona" and second to GORDON POND, Long Beach State College, for a display of his scientific illustrations.

The following officers were elected: *President,* GEORGE Y. HARRY, Fish Commission of Oregon, Rte. 3, Box 3, Astoria, Oregon; *Vice-President,* ROBERT M. STORM, Dept. of Zoology, Oregon State College, Corvallis, Oregon; *Secretary-Treasurer,* ANITA E. DAUGHERTY, California State Fisheries Laboratory, Terminal Island, California.—ANITA DAUGHERTY, *Secretary.*

Summary of the 1951 Meeting

THE 31st annual meeting of the AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS was held in Chicago, Illinois, June 27-30, 1951, in conjunction with the AMERICAN SOCIETY OF MAMMALOGISTS. The meetings were sponsored by and held at the Chicago Natural History Museum.

Activities of June 27

THE Board of Governor's meeting was held at the Chicago Natural History Museum and was called to order by PRESIDENT GEORGE S. MYERS at 9 P.M. with 20 governors present. The minutes of the last meeting were dispensed with since they were published in COPEIA 1950(3): 246. The 96 new members obtained since the 1950 meeting were formally elected to membership.

The following were elected to the Board of Governors for a five-year term: W. FRANK BLAIR, CHARLES M. BREDER, JR., CLARK HUBBS, ROBERT F. INGER, CLIFFORD H. POPE, NEIL D. RICHMOND, KARL P. SCHMIDT, DONALD M. SCOTT, RICHARD C. SNYDER, GEORGE F. WEISEL. The following were elected to Honorary Foreign Membership: J. GUIBÉ, Paris; H. RENDAHL, Stockholm; G. SCORTECCI, Genoa; and E. TREWAVAS, London.

The Secretary reported on the Endowment Fund which now totals $5435.34; $4000 of which is invested in four $1000 series E U. S. Savings Bonds and $1435.34 cash in a savings account in the Ithaca Savings and Loan, Ithaca, New York. This represents an increase of $738.29 since June 19, 1950. The Finance Committee was directed to consult with experts in the investment field and members of the AMERICAN SOCIETY OF MAMMALOGISTS who have been involved in investment activities, and to invest the cash now available in the Endowment Fund in an investment trust, two or more listed stocks or in republication activities of this Society. The Frederick H. Stoye Fund consists of three $1000 series G U. S. Savings Bonds. The income is used for student awards at the annual national meeting. The Revolving Research Fund has a balance of $1370.25 in the Tompkins County Trust Company, Ithaca, New York. No receipts or expenditures were noted during the past year. The Treasurer was empowered to deposit part of the Revolving Research Fund in a federally insured Building and Loan.

Publications Secretary, N. BAYARD GREEN, reported that the transfer of the back issues of COPEIA to Marshall College, Huntington, West Virginia, was completed in December, 1950. As of June 24, 1951, all back orders had been filled and all requests for prices have been answered. At present, 33 issues of the Old Series, and 9 of the New Series are out-of-print. Also 9 issues of the Old Series and 3 issues of the New Series are

almost exhausted (ten or fewer copies). The cost of lithoprinting 300 copies of an 8-page issue, 6x9 inches, on both sides of 40-lb. offset paper, stitched with saddle wire stitching, with self covers, and the completed books trimmed on three sides is $15.00. To lithoprint the 32-page numbers would cost $54.50. Inasmuch as the lithoprinted numbers of 8 pages could be sold for 25¢ each, and the 32-page issue for $1.00, the Society would recover its investment upon the sale of 60 copies. There are on hand back orders for about 25 of each of these out-of-print issues at the present time. Moreover other orders would be placed as soon as these issues are again available. Since it is unlikely that very many of the out-of-print issues will be purchased from former members, and since the initial investment of $500 to $600 by the Society for the lithoprinting of these issues would probably be recovered within a year with a substantial profit to the Society eventually, the Publications Secretary recommended that the Board weigh this matter carefully and reach a decision at this meeting. Since January 1, 1951, the income from the sale of COPEIA through the office of the Publications Secretary is $1538.95. From the tone of the requests for information on back issues he believes that an additional $500 will be taken in before the end of the year. In an average year he expects that from $800 to $1000 per year can be realized from the sale of the back issues. The Publications Secretary was authorized to spend $500–$600 to reprint the back issues of the Old Series of COPEIA.

The Treasurer was empowered to send 40 pounds to the Zoological Society of London as a gift from the Society toward the cost of the 1950 *Zoological Record*. An anonymous donor among the Governors gave 10 pounds to be added to the above gift.

The Board recommended that the 1952 meeting be held in Austin, Texas, from April 11 to 14. It was suggested that the local committee take cognizance of J. L. BAUGHMAN's invitation to meet one day at Rockport, Texas.

The Secretary was instructed to express to the Secretary of the AMERICAN SOCIETY OF MAMMALOGISTS an interest in meeting in Cambridge, Massachusetts, New York City, Pittsburgh, or some other eastern city in 1953. A June meeting is preferred.

The Secretary reported briefly on the meeting of the Governing Board of the AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES held in Washington, D. C., May, 1951. Activities are outlined in the A.I.B.S. *Bulletin*, 1(3): 8, which is mailed to all members of the Society.

The Historian reported that he has in his possession about 450 biographical sketches of members of the Society and a partial set of COPEIA (complete to 1942) which is the property of the Society.

Action was taken authorizing ROGER CONANT to choose the color plate to be published in a future issue of COPEIA when the fund which he is procuring, and which now totals $200, is adequate.

The Editor was authorized to maintain and bind at the Society's expense, the official Society set of COPEIA now in his hands. This set is to be passed on to the succeeding Editor. After a long discussion of COPEIA printing costs the Publications Committee was authorized to get other bids on printing COPEIA in 1952 and to make any desired changes in the size and format of COPEIA and to change printers if economies warrant. The Board provided that at least one author of all feature (10 point) articles must be a member of the Society and that a non-member may publish no more than one note during the year. Papers obtained by invitation of the Editor are excepted from the above provision. The Board was generally agreed that when funds permit it would be desirable to accept some longer papers for COPEIA than can now be printed. The Secretary was directed not to give a discount to any subscription agency from the set subscription price of COPEIA (now $6.00).

A revised constitution and by-laws was approved, posted and action was recommended at the annual business meeting. The meeting adjourned at 11:50 P.M.

Sessions of June 28

REGISTRATION was held in the Foyer of the James Simpson Theater, Chicago Natural History Museum, between 8:30 and 10 A.M. The morning session was opened at 10:10 A.M. with PRESIDENT GEORGE S. MYERS presiding. COLONEL CLIFFORD C. GREGG, Director, the Chicago Natural History Museum, welcomed the society, and PRESIDENT MYERS responded for the society.

The President appointed the following committees.

Nominating: M. Graham Netting, Gerald P. Cooper, W. I. Follett, Milton Trautman and Karl P. Schmidt.

Auditing: George A. Moore and Howard E. Evans.

Resolutions: Joseph R. Bailey, William A. Gosline and Donald E. Wohlschlag.

Awards: Norman Hartweg, Reeve *M.* Bailey, Howard K. Gloyd, Ernest A. Lachner and William H. Stickel.

The following papers were read:

Breeding behavior patterns in Texas Syrrhophus and Eleutherodactylus.—David L. Jameson.
Narial breathing in fishes and the evolution of internal nares.—James W. Atz.
Problems in Hawaiian ichthyology.—William A. Gosline.
Some studies in the leg-length variations of the wood-frog.—Howard K. Suzuki.
The status of Lanthanotus, an alleged relative of Heloderma in Borneo.—Charles M. Bogert.
Viviparity in lower vertebrates.—George S. Myers.

At 12:30 P.M. a group photograph was taken on the west steps of the Museum with Loren P. Woods in charge. Copies of the photograph are available at $2.00 from Flash Foto Company, 36 West Randolph Street, Chicago 1, Illinois.

Concurrent sessions were held at 2 P.M. in the afternoon. The ichthyological session was held in the meeting room with John Tee-Van presiding. The following papers were read:

Fishes from intermediate depths in the Gulf of Mexico.—Hurst H. Shoemaker and Loren P. Woods.
Mechanism of insemination in poeciliid fishes.—Donn Eric Rosen.
Observations on mixing of fresh- and salt-water fishes in Maryland waters.—Romeo Mansueti.
Changes in fish distribution and abundance in Ohio since 1800, caused primarily by increased turbidity and siltation.—Milton B. Trautman.
Structural variation in the channel catfish.—John Greenbank and Reeve M. Bailey.
Systematics and variation in the percid fish Hadropterus crassus.—Edward C. Raney.
The correlation of brain pattern and feeding habits in some cyprinid fishes.—Howard E. Evans.

The herpetological session was held in the lecture hall with Charles M. Bogert and Norman Hartweg presiding. The following papers were read:

Snakes of the genus Clelia.—Joseph R. Bailey.
Preliminary notes on the herpetofauna of southwestern Michoacan.—James A. Peters.
A general discussion of evolution in garter snakes.—Wade Fox, Jr.
Giant frogs and toads.—George S. Myers and John W. Funkhouser.
The rate of differentiation in reptiles and amphibians as suggested by an examination of the Guatemalan herpetofauna.—L. C. Stuart.
Copulatory adjustment in snakes and its evolutionary implications.—Richard A. Edgren.

A tea was held for the ladies in Stevens Hotel at 4 P.M.

At 6:30 P.M. the annual banquet was held jointly with the American Society of Mammalogists in the museum cafeteria and it was followed by an address in James Simpson Theater entitled "Into Central Australia" by Alfred M. Bailey, Director, Denver Museum of Natural History.

Activities of June 29

THE annual business meeting, held in the lecture hall, was called to order by President Myers at 9 A.M. The minutes of the 1950 meeting, published in Copeia 1950(3), were not read. The Secretary reported that 96 new members had been obtained since the last meeting and 12 members were reinstated. During the same period, 27 members resigned, 65 were dropped for nonpayment of dues and 10 died, making a total loss of 102, leaving a net gain of 6. The Society membership stands at 924 members and of these, 42 are fully paid life members and 14 are partly paid life members. During the same period the Society gained 30 new subscribers and reinstated one; 25 were dropped and 1 resigned leaving a net gain of 5 and a total subscription list of 271. The combined membership and subscribers list numbers 1195, with 20 honorary foreign members making a grand total of 1215. Geographic tabulations indicate that 196 copies of Copeia go to 43 foreign countries. Canada leads with 47 and is followed by U.S.S.R. with 18 and England with 16. Domestic copies total 1021 and go to all states of the Union. California leads with 146, followed by New York with 112, Michigan with 107, Pennsylvania with 50, Texas with 50, and Illinois with 49. Beginning with Copeia 1951(1), 1700 copies were printed, an increase of 200 over 1950.

The following financial report for the calendar year January 1 to December 31, 1950, was submitted by the Treasurer, Dwight A. Webster, and was read by the Secretary.

RECEIPTS

Dues Received		
Current dues for 1950, at $4.50 or $5.00	$4259.97	
Back dues for 1949 and before	83.50	
Advance dues for 1951 and beyond	1444.50	
		$5787.97
Subscriptions received		
Current subscriptions for 1950	815.50	
Back subscriptions for 1949 and before	19.50	
Advance subscriptions for 1951 and beyond	706.50	
		1541.50
Reprints paid for, a reimbursement for bills previously paid out		1234.68
Back numbers of COPEIA sold		147.26
Miscellaneous receipts		2.24
Contributions		
ROGER CONANT (for future color plate, COPEIA)	100.00	
R. E. JOHNSON (for 1950 prizes)	50.00	
A. E. DAUGHERTY (for 1950 prizes)	15.00	
G. W. TEAGUE	100.00	
W. I. FOLLETT	25.00	
MISCELLANEOUS	2.00	
		292.00
Interest F. H. STOVE Fund (to be used for prizes)		112.50
		$9118.15

EXPENDITURES

Costs of publication of COPEIA		
COPEIA, 1949, No. 4	$1322.72	
COPEIA, 1950, No. 1	1061.05	
COPEIA, 1950, No. 2	1300.82	
COPEIA, 1950, No. 3	1112.61	
		$4797.20
Reprint costs of COPEIA (will be returned to Society)		
COPEIA, 1946, No. 1	9.50	
COPEIA, 1949, No. 3	260.04	
COPEIA, 1949, No. 4	205.23	
COPEIA, 1950, No. 1	323.58	
COPEIA, 1950, No. 2	351.75	
		1150.10
Printing of stationery, due bills, envelopes		100.13
Stenographic service for Secretary		221.00
Postage		
Secretary (Ithaca)	97.24	
Editors (Ann Arbor)	60.00	
Publications Secretary (Huntington, W. Va.)	50.00	
		207.24
Annual meeting in Salt Lake City		
Expense of Secretary		103.76
Prizes awarded at annual meeting		
ROBERT R. HARRY	25.00	
CONRAD LIMBAUGH	15.00	
RAYMOND SANDERS	25.00	
RICHARD G. ZWEIFEL	15.00	
JAY M. SAVAGE	15.00	
HARRY W. FREEMAN	12.50	
NORMAN J. WILIMOSKY	12.50	
		120.00
Contributions		
Remittance of 50 pounds to the ZOOLOGICAL SOCIETY OF LONDON to assist in publication of 1948 *Zoological Record*		141.53
Dues		
AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES, 1949 dues		615.00
AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES, 1950 dues		752.50
Transportation to move back issues of COPEIA		40.00
Misc. debits, postage of back issues, telegrams, bank charges, etc.		85.86
Total expenditures and disbursements		$8334.32
Excess receipts over expenditures		783.83
		$9118.15

Bank balance in the First National Bank of Ithaca, New York, on June 23, 1951, was $4,846.46. The sum of $1538.95 is deposited in Huntington, West Virginia, leaving the total of cash on hand at $6385.41.

The *Auditing Committee* reported that the Treasurer's report was seemingly in good order.

The Publications Secretary and Historian reported briefly (see report of Governors' meeting).

The Editor reported a goodly supply of manuscript on hand so that members can expect six to twelve months lag in publication time. The Society gave a hearty vote of thanks to the Editors for their fine work during the year.

The Chairman of the *Committee on Traffic in Venomous Reptiles,* ROGER CONANT, reported that the U. S. Fish and Wildlife Service and the U. S. Public Health Service had both expressed interest in the possibility that exotic poisonous snakes might escape from captivity and might become established within the borders of the United States. The Committee had been in touch with both these services and had also looked into previous instances in which foreign species have been introduced into this country. It was the unanimous opinion of the Committee members that control over the importation of venomous snakes is not warranted at this time. The Committee suggested, however, that the AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS prepare a set of recommendations that will serve as a guide in case federal action may some day become necessary.

ROBERT H. MCCAULEY, JR., representing the Public Health Service, reported that he had investigated the matter at the behest of his superiors, and that his findings were similar to those of the Committee. He also pointed out that the Public Health Service was ready to accept the responsibility of initiating any regulations that might become necessary. WILLIAM H. STICKEL, of the U. S. Fish and Wildlife Service, also commented. The Society voted to adopt the report and recommendation of the committee. PRESIDENT MYERS reappointed the present committee, consisting of ROGER CONANT, Chairman, E. R. DUNN, and C. M. BOGERT, and instructed them to prepare the recommendations as suggested. He also appointed two additional members to the Committee—DR. MCCAULEY and WILLIAM H. STICKEL.

KARL P. SCHMIDT reported on a *Check List of North American Amphibians and Reptiles.* The first draft is now finished and December 31, 1951, has been set as the closing date for manuscript.

A revised Constitution and By-Laws was adopted.

The nominating committee reported and the following officers were elected: *Honorary Presidents*—JOHN TREADWELL NICHOLS (Ichthyology) and HELEN T. GAIGE (Herpetology); *President*—GEORGE S. MYERS; *Vice-Presidents*—JOHN TEE-VAN, GEORGE P. MEADE and GEORGE A. MOORE; *Treasurer*—DWIGHT A. WEBSTER; *Secretary*—EDWARD C. RANEY; *Publications Secretary*—N. BAYARD GREEN; *Editor-in-Chief*—GERALD P. COOPER; *Ichthyological Editor*—ROBERT R. MILLER; *Herpetological Editor*—NORMAN HARTWEG; *Editorial Board*—CHARLES M. BOGERT, LAURENCE M. KLAUBER, ROLF L. BOLIN, ERNEST A. LACHNER and RAYMOND E. JOHNSON; *Historian*—WALTER L. NECKER.

The business meeting adjourned at 11 A.M.

The regular sessions continued with a report of the *Committee on Zoological Nomenclature* given by the chairman, W. I. FOLLETT. Following considerable discussion the report was accepted. The following papers were read:

A review of certain of the changes in nomenclatorial practice effected by the thirteenth International Congress of Zoology, Paris, 1948.—W. I. Follett.

The aggregation and dispersal of animal populations. A yearlong study of a brown bullhead population.—Donald E. Wohlschlag.

The afternoon sessions were again divided. The Herpetological group assembled in the Lecture Hall at 2 P.M. with M. GRAHAM NETTING presiding. The following papers were read:

Locomotion of lizards: quadrupedal and bipedal.—Richard C. Snyder.

Growth of the green frog, Rana clamitans, in the Ithaca area.—Richard A. Ryan.

Observations on the glass snake, Ophisaurus ventralis.—W. J. Hamilton, Jr. and Joseph A. Pollack.

The forms of North American Ophisaurus.—Edwin H. McConkey.

Adaptations to egg-eating in the Japanese snake Elaphe climacophora.—Carl Gans.

The *Committee on Fish Classification* met at 2:30 P.M. with committee members GEORGE S. MYERS, REEVE M. BAILEY, EDWARD C. RANEY and JOHN TEE-VAN in attendance. Ten other interested ichthyologists attended and participated in the discussion. A report of this session will appear elsewhere in COPEIA.

At 6:30 the Society joined the AMERICAN SOCIETY OF MAMMALOGISTS at a buffet supper served in the museum cafeteria. At this time the FREDERICK H. STOYE awards were announced. The first prize of $25 in ichthyology went to DONN ERIC ROSEN. There was a tie for first place in herpetology and EDWIN H. MCCONKEY and JAMES A. PETERS were awarded $25 prizes. The local committee also gave prizes to GEORGE S. MYERS in ichthyology and ROMEO MANSUETTI in herpetology for high scores made on a bibliographic questionnaire filled in at the annual banquet.

The following resolutions were offered by the committee:

Whereas, the 31st Annual Meeting of the AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS held at the Chicago Natural History Museum in Chicago, Illinois, from June 27 through June 30, 1951, has been successfully concluded:

Therefore, be it resolved: that the members of this Society express their deepest appreciation and thanks for the many courtesies extended by: (1) *The Local Committee:* KARL P. SCHMIDT, Chairman; HOWARD K. GLOYD, CLIFFORD H. POPE and LOREN WOODS and the Director, COL. CLIFFORD C. GREGG and Staff of the Chicago Natural History Museum. (2) The Chicago Zoological Society for the visit and lunch at the Brookfield Zoo. (3) The wives of the *Entertainment Committee* for an excellent tea offered the visiting wives.

Activities of June 30

ON Saturday, June 30, members of the Society were the guests of the Chicago Zoological Society at the Brookfield Zoo where they enjoyed a fine outing including a luncheon given by the Zoological Society.

The *Publications Committee* met at the Museum at 9 A.M., with GERALD P. COOPER, NORMAN HARTWEG, ERNEST A. LACHNER, ROBERT R. MILLER and EDWARD C. RANEY present.

A total of 98 members registered and paid the $1 fee to cover partial local expenses. —EDWARD C. RANEY, *Secretary.*

Texas Meetings 1952

LOCAL Committee Chairman W. FRANK BLAIR gives the following tentative plans for the meetings scheduled for April 10–13, 1952 at Austin, Texas. Board of Governors Meeting at 8 P.M. on Thursday, April 10, at the *Stephen F. Austin* Hotel; formal papers on Friday and Sunday; Annual Dinner Sunday evening; field trips all day on Saturday, separately for ichthyologists and herpetologists. Accommodations at *Stephen F. Austin:* single, $3.50–$6.00; double, $5.00–$10.50; dormitory (4 or more per room), $2.00. Tourist courts and a convenient camping site are also available; those planning to camp out should notify W. FRANK BLAIR, Department of Zoology, University of Texas, Austin. Meetings, except that of Board of Governors, will be held in the Experimental Science Building, University of Texas. Titles for papers and abstracts must be submitted before March 1 to DR. BLAIR. Persons wishing to do herpetological collecting while traveling to or from the meetings may obtain guide service in Texas, by writing before March 1 to D. L. JAMESON, Department of Zoology, University of Texas, indicating where, when and what they wish to collect.

Correction

IN COPEIA, 1951, No. 2, on page 158, transpose lines 2 and 48; i.e., the second line from the top of the page and the fourth line from the bottom.

New Journals

TWO new journals, *The Amsterdam Naturalist* and *Beaufortia,* appeared in 1951. The first is a monthly of scientific scope but adapted to the general reader and constitutes the Bulletin of the Zoological Museum of Amsterdam. It is to contain surveys of biological work and short notes, in general on Dutch activities. The editors are H. Engel and J. J. Hoedeman. *Beaufortia,* also published by the same institution, represents a series of miscellaneous publications at the scientific level. No. 1, on fishes of the genus *Aphanius* (by J. J. Hoedeman), appeared on March 5.

News Notes

ON October 1, 1951, the secretaryship of the Netherlands Society of Vivarium-keepers, publisher of *Lacerta,* was assumed by TH. J. P. CORNELISSEN, Pleiadenstraat 146, Haarlem N., The Netherlands.

DR. JAMES A. OLIVER, formerly of the Department of Biology, University of Florida, began his duties as Curator of Reptiles in the Bronx Zoo on September 1.

MR. RICHARD J. BALDAUF, Department of Biology, Agricultural and Mechanical College of Texas, College Station, Texas, is engaged in an osteological study of various species of toads. At this time he particularly needs skeletal material (or living specimens from which he may prepare skeletons) of the following species of *Bufo*: *compactilis, horribilis, insidior, punctatus, valliceps, boreas, debilis, californicus, canorus, exsul, terrestris* and *woodhousei.*

The Naturalists' Directory, 36th edition, has been published at Salem, Massachusetts, and sells for $3.00, postpaid.

According to the *Outdoor News Bulletin* of November 16, 1951, the hunting season on Florida alligators will be re-opened in 1952. Alligators under 8 feet in length will be completely protected on the assumption that an adequate breeding stock will thus be maintained.

DR. ALFRED S. PERLMUTTER spent about six weeks in Israel last summer and was particularly impressed with the pond culture work on carp being carried out at the Seafisheries Research Station. This station, with address at Box 699, Haifa, Israel, is badly in need of ichthyological literature.

DR. JUSTIN W. LEONARD has resigned from the Institute for Fisheries Research to become Research Administrator for the Michigan Department of Conservation, with office in Lansing.

DR. RAYMOND E. JOHNSON resigned on August 24 from the Minnesota Department of Conservation and on August 27 joined the Branch of Federal Aid, U.S. Fish and Wildlife Service, with the new address at 1006 West Lake Street, Minneapolis 8, Minnesota. His duties are concerned primarily with organization and continuance of the new Dingell-Johnson fisheries restoration and management program, and he will work entirely within Region 3—the north-central states from Ohio west and south to Missouri, Nebraska, and the Dakotas. All Great Lakes states except New York and Pennsylvania lie in this region.

DR. MASON W. LAWRENCE, New York Conservation Department, and MR. WARREN S. LANDERS, U.S. Fish and Wildlife Service, were elected president and secretary-treasurer at the annual meeting of the Atlantic Fisheries Biologists Society, held at Rangely, Maine, October 5–7, 1951.

The Southern Fisheries District of the New York State Conservation Department has moved into new quarters at 311 Mill Street, Poughkeepsie, N.Y. The staff consists of CECIL E. HEACOX, Senior Aquatic Biologist; JOHN GRIM, Aquatic Biologist; JOHN GOULD, Aquatic Biologist; and FRANK TOMAN, Analytical Chemist.

NORMAN J. WILIMOVSKY returned on September 21 from three months of intensive field work along the Arctic coast of Alaska, under the sponsorship of the Arctic Research Laboratory of the U.S. Navy. Some 100 individual collections were made during the very mild summer, resulting in new records for the Arctic coast and a wealth of comparative material to be used in a comprehensive faunal report on the Arctic fish fauna. An opportunity to work off an ice-breaker, equipped with oceanographic facilities, yielded collections from greater depths than have been made previously. Sonic characteristics of the fishes also were investigated.

The Danish biologist DR. HARALD BLEGVAD, 65, died on August 21, 1951. He was an expert on fish and fishing and served for years as adviser of several foreign governments.

The annotated list and keys to the fishes of Iowa, by R. M. BAILEY, published in *Iowa Fish and Fishing*, have been reprinted and are available for 25 cents a copy at the State of Iowa Printing Board, Des Moines.

Word has been received of the death of the Russian ichthyologist PETER J. SCHMIDT, who died evidently sometime during 1949 at the age of 77. He was elected an Honorary Foreign Member of this Society in 1939. PROFESSOR SCHMIDT worked primarily on North Pacific fishes and his "Fishes of the Okhotsk Sea" (in Russian, no English summary) appeared in 1950.

The fifth ichthyological reconaissance to the Central Pacific by the School of Tropical and Preventive Medicine at Loma Linda, California, was made late in October. MR. NORMAN C. BUNKER is associated with DR. BRUCE W. HALSTEAD in a project financed and sponsored by the U.S. Public Health Service and the Office of Naval Research. He collected fishes and ecological data which will be used in the current investigation on poisonous and venomous fishes and their relationship to isolated military personnel.

The editors gratefully acknowledge help given by MRS. HELEN T. GAIGE in preparing the Index for 1951 which appears in this issue.

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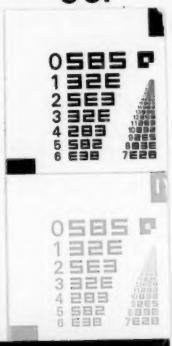
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